

SPECIES KNOWN OR LIKELY TO OCCUR IN ST. FRANCOIS COUNTY

KNOWN TO OCCUR

GENERAL HABITAT

COMMENTS ON OCCURREN
IN MISSOURI

BASS, LARGEMOUTH

OCCURS IN PONDS,
LAKES AND
RESERVOIRS,
BACKWATERS,
AND POOLS OF STREAMS
WITH LOW FLOW.

OCCURS STATEWIDE
01

40111374



SUPERFUND RECORDS

BASS, ROCK

PREFERS WARM,
MODERATELY CLEAR
WATER WITH LITTLE OR
NO CURRENT AND
LOW SILTATION.
OCCUR IN STREAMS,
DITCHES AND
BACKWATERS WITH
CLEAR
WATER, LOW

OCCURS IN THE OZARKS
06

SILTATION, AND SLOW
TO MODERATE CURRENT.

BASS, SMALLMOUTH

PREFER AREAS WITH
COVER SUCH AS
BOULDERS, LOGS, OR
AQUATIC VEGETATION.

OCCURS THROUGHOUT
OZARKS, SPARINGLY IN
UPPER MISS. RIVER
AND ITS PRINCIPAL
PRAIRIE TRIBS. AND
IN THE LAMINE RIVER
DRAINAGE *01*

OCCURS IN CLEAR,
COOL STREAMS WITH
PEBBLE, GRAVEL
OR RUBBLE BOTTOM AND
LOW SILTATION.

BLUEGILL

PREFER AREAS
WITH COVER SUCH AS
BOULDERS, ROOTWADS,
OR AQUATIC
VEGETATION.

OCCURS IN NATURAL
WATERS OVER MOST OF
MO, HAS BEEN STOCKED
IN MAN-MADE
IMPOUNDMENTS
THROUGHOUT THE STATE
01

OCCURS IN
IMPOUNDMENTS,
OVERFLOW PONDS,
OXBOW LAKES,
AND POOLS OR
BACKWATERS OF
STREAMS. PREFERS
WARM,

BULLHEAD, BLACK

CLEAR WATER WITH
AQUATIC VEGETATION.
INHABITS POOLS,
BACKWATERS, OXBOWS,
SLOUGHS AND
IMPOUNDMENTS.
PREFERS TURBID
WATER, LITTLE OR NO
CURRENT AND SILT
BOTTOM.

OCCI
STA1
OFTF
PRAI
REGI
WEST

Big River Mine Tails

Disposal, MO.

*17.8 Site Management Assoc.
Reference Docs.*

10OCCUR IN ST. FRANCOIS COUNTY

GENERAL HABITAT

COMMENTS ON OCCURREN
IN MISSOURI

BULLHEAD, YELLOW

OCCURS IN SLOUGHS,
BACKWATERS AND POOLS
OF STREAMS WITH
CLEAR WATER, DENSE
AQUATIC VEGETATION,
AND LITTLE OR NO

IS THE COMMONEST
BULLHEAD IN THE
OZARKS & S.E.
LOWLAND
REGION *01*

CHUB, CREEK

CURRENT.
INHABITS SMALL
HEADWATER CREEKS
WITH GRAVEL RIFFLES.
TOLERATES WIDE RANGE
OF TURBIDITY.
OCCURS IN CLEAR TO
MODERATELY TURBID
STREAMS WITH
GRAVELLY OR ROCKY
RIFFLES AND SLIGHT
TO MODERATE
CURRENT.

MOST ABUNDANT IN
SMALL HEADWATER
CREEKS.*01*

CHUB, GRAVEL

INHABITS RIFFLES OF
CLEAR STREAMS WITH
MODERATE CURRENT
AND GRAVEL OR RUBBLE
BOTTOM.

COMMON IN N & W
OZARKS, ALSO FOUND
IN SALT R. IN NE MO,
&
IN 1 LOCALITY IN
BOTH THE CURRENT R.
& LOWER MISS. R *01*
OCCURS IN ALL
PRINCIPAL STREAM
SYSTEMS OF THE
OZARKS NOT
OCCUPIED BY THE
REDSPOT CHUB *01*
WIDESPREAD, BUT NOT
ABUNDANT IN EAST. &
SOUTH. OZARKS,
AVOIDS LOWLANDS &
ABSENT FROM OZARK
STREAMS OF MISSOURI
& SPRING RIVER
SYSTEMS.*01*

CHUB, HORNYHEAD

CHUBSUCKER, CREEK

OCCURS IN POOLS,
INLETS AND OVERFLOW
POOLS OF SMALL
CREEKS. PREFERS
AREAS WITH CLEAR
WATER, DENSE
SUBMERGED
VEGETATION AND SAND
OR SILT BOTTOMS WITH
ORGANIC DEBRIS.

MOST PREVALENT IN
LARGE, OZARK
RESERVOIRS,
NAVIGATION
POOLS OF UPPER MS
R., & NATURAL LAKES
& BORROW PITS OF
LOWLANDS.*03*
PREVALENT IN
IMPOUNDED WATERS OF
ALL SIZES *07*

CRAPPIE, BLACK

OCCURS IN LAKES,
RESERVOIRS, BORROW
PITS AND NAVIGATION
POOLS IN LARGE
RIVERS. PREFERS
AREAS WITH LITTLE OR
NO
CURRENT, CLEAR
WATER, AND ABUNDANT
COVER SUCH AS
SUBMERGED
TIMBER OR AQUATIC
VEGETATION.

OCCURS IN THE OZARK
UPLAND REGION *01*

DACE, SOUTHERN
REDBELLY

INHABITS SMALL
STREAMS WITH CLEAR
WATER, SWIFT
CURRENT,
AND SAND, PEBBLE OR
GRAVEL BOTTOMS.

10CCUR IN ST. FRANCOIS COUNTY

GENERAL HABITAT

COMMENTS ON OCCURREN IN MISSOURI

DARTER, BANDED

INHABITS ROCKY
RIFFLES OR
BOULDER-STREWN POOLS
WITH
SUFFICIENT CURRENT
TO PREVENT SILT
DEPOSITION IN
CLEAR PERMANENT
STREAMS.

OCCUR IN ALL
PRINCIPAL STREAM
SYSTEMS OF OZARKS
01

DARTER, FANTAIL

OCCUR IN SPRING
BRANCHES AND STREAMS
WITH MODERATE TO
SWIFT CURRENTS AND
GRAVEL BOTTOMS.
INHABIT PERMANENT
STREAMS WITH CLEAR
WATER AND

OCCUR IN MOST OF
OZARKS AND NE INTO
TRIBS. OF UPPER
MISS.
RIVER *01*
OCCURS IN STREAMS OF
E. AND S. OZARKS
01

DARTER, GILT

DARTER, GREENSIDE

GRAVEL BOTTOMS.
INHABIT RIFFLES AND
POOLS WITH CURRENT
IN PERMANENT
STREAMS WITH GRAVEL,
RUBBLE, BOULDER OR
BEDROCK BOTTOMS.

OCCURS IN THE OZARKS
OF MO

DARTER, JOHNNY

OCCURS IN OXBOWS AND
POOLS OF STREAMS
WHERE CURRENT IS
SLOW AND THERE IS A
BOTTOM OF MUD, SAND
OR GRAVEL.

OCCUR THROUGHOUT
MOST OF STATE EXCEPT
LOWLANDS, S. CENTRAL
OZARKS AND PARTS OF
WESTERN PRAIRIE
AREAS *01*
OCCURS IN STREAMS OF
N. OZARKS FROM
MOREAU AND OSAGE
STREAM SYSTEMS EAST
TO THE MERAMEC *01*

DARTER, MISSOURI
SADDLED

INHABITS SWIFT
RIFFLES OF STREAMS
WITH CLEAR WATER,
HIGH GRADIENT AND
GRAVEL OR RUBBLE
BOTTOMS.

DARTER, ORANGETHROAT

OCCURS IN SLUGGISH
RIFFLES OR POOLS
WITH CURRENT IN
SMALL STREAMS OR
SPRING BRANCHES WITH
GRAVEL OR
ROCK BOTTOMS.

OCCUR THROUGHOUT
OZARKS AND NORTHERN
OZARK BORDER AND
WESTWARD IN TRIBS.
OF MO RIVER TO CLAY
AND JACKSON
COUNTIES *01*
OCCUR IN OZARKS, ALL
PRINCIPAL STREAM
SYSTEMS EXCEPT THE
SPRING R. AND ELK R.
03

DARTER, RAINBOW

OCCURS IN SWIFT
RIFFLES OF STREAMS
AND SPRING
BRANCHES WITH CLEAR
WATER AND GRAVEL,
GRAVEL-COBBLE
OR GRAVEL-BOULDER
BOTTOMS.

1 OCCUR IN ST. FRANCOIS COUNTY

GENERAL HABITAT

COMMENTS ON OCCURREN
IN MISSOURI

MADTOM, FRECKLED

OCCURS IN STREAMS OR
DITCHES WITH CLEAR
OR MODERATELY TURBID
WATER, GRAVEL,
RUBBLE OR MUD BOTTOM
AND SLUGGISH
CURRENT.

OCCURS COMMONLY IN
THE UPPER MISS. &
OSAGE RIVERS, & IN
STREAMS & DITCHES OF
THE MISS. LOWLANDS
01

MADTOM, SLENDER

USUALLY FOUND ALONG
UNDERCUT BANKS AMONG
ORGANIC DEBRIS.
OCCURS IN SMALL TO
MEDIUM-SIZE STREAMS
WITH CLEAR WATER AND
GRAVEL OR RUBBLE
BOTTOM. USUALLY
FOUND ON RIFFLES
WITH CURRENT
8-92 CM PER SECOND.
OCCASIONALLY FOUND
IN POOLS WITH
CURRENT.

IS COMMON OVER MOST
OF THE OZARKS & IN
THE CLEARER PRAIRIE
STREAMS OF
NORTHEASTERN MO *01*

MINNOW, BLUNTNOSE

OCCURS IN POOLS AND
BACKWATERS OF CLEAR
STREAMS WITH
MUD, SAND, GRAVEL OR
RUBBLE BOTTOMS, AND
MODERATE
AMOUNTS OF AQUATIC
VEGETATION.

OCCURS THROUGHOUT MO
EXCEPT IN EXTREME NW
CORNER. MOST
ABUNDANT ALONG OZARK
BORDER & IN NE PART
OF PRAIRIE REGION
01

MINNOW, FATHEAD

OCCURS IN

COMMON IN PRAIRIE

MINNOW, OZARK

MINNOW, SILVERJAW

IMPOUNDMENTS,
BACKWATERS AND POOLS
OF STREAMS
WITH MUD OR SILT
BOTTOMS. TOLERATES
HIGH TEMPERATURE AND
TURBIDITY AND LOW
DISSOLVED OXYGEN.
INHABITS BACKWATERS
AND POOLS OF CLEAR
PERMANENT STREAMS
WITH HIGH GRADIENTS
AND GRAVEL OR RUBBLE
BOTTOMS.
INHABITS POOLS AND
RIFFLES OF CLEAR
PERMANENT STREAMS
WITH MODERATE
GRADIENT AND SAND,
GRAVEL OR BEDROCK
BOTTOM.

REGIONS OF N & W MO,
MOST OZARK RECORDS
PROBABLY DUE TO
RELEASES FROM BAIT
BUCKETS OR HATCHERY
ESCAPES *01*

OCCURS IN THE OZARK
UPLAND REGION *01*

OCCURS IN A FEW
LOCALITIES IN THE
MERAMEC R. SYSTEM, &
SOUTHWARD IN DIRECT
TRIBUTARIES OF THE
MISS. R. *01*

10OCCUR IN ST. FRANCOIS COUNTY

GENERAL HABITAT

REDHORSE, BLACK

REDHORSE, GOLDEN

REDHORSE, SHORTHEAD

SHINER, BIGEYE

SHINER, BLEEDING

SHINER, REDFIN

OCCURS IN POOLS WITH
CURRENT IN CLEAR
PERMANENT STREAMS
WITH MODERATE TO
SWIFT CURRENT AND
PEBBLE, GRAVEL OR
RUBBLE BOTTOMS.
OCCURS IN POOLS AND
RIFFLES OF
MODERATELY CLEAR
PERMANENT
STREAMS WITH
MODERATE SILTATION,
MODERATE CURRENT AND
GRAVEL OR ROCKY
BOTTOMS.
OCCURS IN POOLS AND
RIFFLES OF PERMANENT
STREAMS AND
DITCHES WITH CLEAR
WATER, MODERATE TO
SWIFT CURRENT AND
PEBBLE, GRAVEL OR
RUBBLE BOTTOM.
INHABITS WARM, QUIET
POOLS AND BACKWATERS
OF
PERMANENT STREAMS
WITH CLEAR WATER,
ABUNDANT
VEGETATION AND SAND,
GRAVEL OR BEDROCK
BOTTOMS.
INHABITS RIFFLES AND
POOLS WITH CURRENT
IN CLEAR
PERMANENT STREAMS OR
SPRING BRANCHES WITH
PEBBLE
OR GRAVEL BOTTOMS.
OCCURS IN SLOUGHS,
DITCHES AND STREAMS
WITH WARM

COMMENTS ON OCCURREN
IN MISSOURI

RESTRICTED TO OZARKS
IN MISSOURI.*01*

THROUGHOUT OZARK
UPLANDS, PENETRATES
NORTHEASTWARD INTO
PRAIRIE STREAMS OF
UPPER MS.
DRAINAGE.*01*

COMMON & WIDESPREAD
IN OZARKS, BUT
ABSENT FROM MUCH OF
WHITE R. SYSTEM,
ALSO ABUNDANT IN NE
PART OF PRAIRIE
REGION.*01*

OCCURS OVER MOST OF
THE OZARK UPLANDS, &
IN TRIBUTARIES OF
THE MISS. R.
NORTHWARD TO LEWIS
COUNTY *01*

RESTRICTED TO OZARK
UPLANDS. OCCURS IN
ALL MAJOR DRAINAGES
NOT OCCUPIED BY
CLOSELY RELATED
DUSKYSTRIPED SHINER
01
OCCUPY NEARLY ALL OF
MO BUT ABSENT FROM
WHITE RIVER SYSTEM

CLEAR WATER,
ABUNDANT SUBMERGED
VEGETATION AND
PEBBLE, GRAVEL OR
RUBBLE BOTTOM.

01

10CCUR IN ST. FRANCOIS COUNTY

	GENERAL HABITAT	COMMENTS ON OCCURREN IN MISSOURI
SHINER, ROSYFACE	INHABITS RIFFLES OR POOLS WITH CURRENT IN PERMANENT STREAMS WITH CLEAR WATER, GRAVEL BOTTOM, AND MODERATE TO HIGH GRADIENT.	OCCUR IN OZARK UPLANDS OF STATE *01*
SHINER, SAND	PREFERS SHALLOW, SANDY POOLS OF PERMANENT STREAMS WITH MODERATE TURBIDITY AND LOW TO MODERATE GRADIENT.	OCCURS THROUGHOUT THE PRAIRIE REGION *01*
SHINER, SPOTFIN	OCCURS ON RIFFLES OF PERMANENT STREAMS WITH CLEAR WATER, SAND, GRAVEL, OR RUBBLE BOTTOM AND SLOW TO MODERATE CURRENT. IS OCCASIONALLY FOUND IN RESERVOIRS.	OCCURS IN THE GASCONADE, MERAMEC, UPPER MISS., & SPRING RIVERS, OCCAS. IN THE LOWER MO & LOWER MISS. R. AS FAR SOUTH AS CAPE GIRARDEAU *01*
SHINER, STEELCOLOR	INHABITS RIFFLES OF PERMANENT STREAMS WITH CLEAR WATER, GRAVEL BOTTOMS, AND MODERATE TO SWIFT CURRENT.	OCCURS IN MERAMEC, ST. FRANCIS, WHITE, & CUIVRE RIVERS, & IN HEADWATER DIVERSION DITCH *01*
SHINER, STRIPED	INHABITS STREAMS AND DITCHES WITH CLEAR WATER AND GRAVEL BOTTOMS.	OCCUR IN DIRECT TRIBS. OF UPPER MISS. RIVER AND MOST OF OZARK UPLANDS *01*
SHINER, WEDGESpot	INHABITS RIFFLES OR ADJACENT POOLS IN PERMANENT STREAMS WITH CLEAR WATER AND SAND, GRAVEL OR RUBBLE BOTTOMS.	RESTRICTED TO OZARK UPLANDS. COMMON OVER MUCH OF MO OZARKS *01*
SILVERSIDE, BROOK	OCCURS IN LAKES, RESERVOIRS, BACKWATERS AND LARGE POOLS OF STREAMS. PREFERS CLEAR, WARM WATER WITH LITTLE OR NO CURRENT, AND MUD OR GRAVEL BOTTOM. SOMETIMES FOUND NEAR BEDS OF AQUATIC VEGETATION.	OCCURS IN THE OZARKS, THE S.E. LOWLANDS, & AT SCATTERED LOCALITIES NORTHWARD ALONG MISS. RIVER. IS MOST ABUND. SMALL FISH IN OZARK RESERVOIRS *01*

10CCUR IN ST. FRANCOIS COUNTY

GENERAL HABITAT

COMMENTS ON OCCURREN

STONEROLLER, CENTRAL

USUALLY FOUND ON GRAVEL, RUBBLE OR BEDROCK RIFFLES IN STREAMS OR SPRING BRANCHES WITH MODERATE TO HIGH GRADIENTS. IS SOMEWHAT TOLERANT OF HIGH TURBIDITY.

STONEROLLER, LARGESCALE

OCCURS ALONG SHALLOW MARGINS OF RIFFLES IN STREAMS AND BACKWATERS WITH GRAVEL OR RUBBLE BOTTOMS.

STUDFISH, NORTHERN

OCCURS IN PERMANENT STREAMS WITH MODERATE TO HIGH GRADIENT, CLEAR WATER, AND SAND, GRAVEL OR ROCK BOTTOM. USUALLY FOUND AT EDGES OF POOLS OR RIFFLES WHERE THERE IS LITTLE OR NO CURRENT.

SUCKER, NORTHERN HOG

INHABITS PERMANENT STREAMS WITH MODERATE TO SWIFT CURRENT, CLEAR WATER, GRAVEL OR RUBBLE BOTTOM. USUALLY FOUND IN RIFFLES, ALSO FOUND IN POOLS WITH CURRENT.

SUCKER, WHITE

INHABITS SMALL STREAMS AND SPRING BRANCHES WITH CLEAR WATER, MODERATE TO HIGH GRADIENTS, GRAVEL OR ROCKY BOTTOMS AND WELL-DEFINED RIFFLES.

SUNFISH, GREEN

OCCURS IN NEARLY ALL AQUATIC HABITATS AND CAN TOLERATE EXTREMES IN TURBIDITY, DISSOLVED OXYGEN, TEMPERATURE AND FLOW.

10 OCCUR IN ST. FRANCOIS COUNTY

GENERAL HABITAT

SUNFISH, LONGEAR

OCCURS IN RESERVOIRS, PONDS, AND IN POOLS, INLETS AND OVERFLOW WATERS OF STREAMS. PREFERS CLEAR WATER AND SAND, GRAVEL OR PEBBLE BOTTOM.

TOPMINNOW,

OCCUR IN VARIETY OF

IN MISSOURI

OCCURS THROUGHOUT MO EXCEPT IN S.E. LOWLANDS & EXTREME N.W. CORNER *01*

IS ALMOST STRICTLY AN OZARK SPECIES *01*

OCCURS IN THE OZARKS & IN SW MO *01*

ABUNDANT & WIDELY DISTRIBUTED IN OZARKS. *01*

COMMON IN CLEARER PRAIRIE & OZARK BORDER STREAMS OF CEN. & NE MO, ABSENT FORM LOWLANDS & ADJACENT OZARK STREAMS. *01*

OCCURS STATEWIDE, IN VIRTUALLY EVERY STREAM IN THE STATE CAPABLE OF SUPPORTING FISH LIFE *01*

COMMENTS ON OCCURREN IN MISSOURI

THIS SPECIES IS THE MOST ABUNDANT & GENERALLY DISTRIBUTED SUNFISH IN SOUTH MO *01*

OCCURS IN THE OZARKS

BLACKSPOTTED

HABITATS, BUT
TYPICALLY IS
FOUND IN QUIET WATER
AT MARGINS OF POOLS
OR
RIFFLES IN CLEAR,
FAST-FLOWING UPLAND
STREAMS.

& THE SE MO LOWLANDS
01

LOGPERCH

OFTEN FOUND NEAR
THICK STANDS OF
EMERGENT VEGETATION.
INHABITS A VARIETY
OF STREAM TYPES BUT
PREFERS DEEPER,
SLUGGISH SECTIONS OF
GRAVELLY RIFFLES.

OCCUR THROUGHOUT
OZARKS AND AT
SCATTERED LOCALITIES
ELSEWHERE *03*

OCCURS ALONG
GRAVELLY, WAVE-SWEPT
SHORES OF
RESERVOIRS. AVOIDS
STREAMS WITH HIGH
TURBIDITY OR
SILTATION.

FROG, BLANCHARD'S
CRICKET

PREFERS MUDDY EDGES
OF STREAMS AND PONDS
WITH DENSE

COMMON - STATEWIDE.
02

BULLFROG

AQUATIC VEGETATION.
OCCURS IN MARSHES,
SWAMPS, SLOUGHS,
PONDS, LAKES, AND
RESERVOIRS WITH

STATEWIDE *01*

FROG, GREEN

AQUATIC VEGETATION.
OCCUR IN SWAMPS,
BOGS, SLOUGHS,
SPRINGS, PONDS AND
STREAMS.

MOST OF STATE EXCEPT
NW. AND EXTREME SE.
PARTS *01*

FROG, PLAINS LEOPARD

INHABIT GRASSLAND.
BREED IN SWAMPS,
MARSHES, STREAMS
OR PONDS WITH
AQUATIC VEGETATION.

OCCUR IN N. HALF OF
STATE *01*

1OCCUR IN ST. FRANCOIS COUNTY

GENERAL HABITAT

COMMENTS ON OCCURREN
IN MISSOURI

FROG, SOUTHERN
LEOPARD

MAY OCCUR FAR FROM
WATER IN GRASSLAND
OR WOODLAND
DURING SUMMER. BREED
IN SWAMPS, MARSHES,
DITCHES,
SLOUGHS, STREAMS AND
PONDS.

STATEWIDE EXCEPT NW
PART OF STATE *01*

MUDPUPPY

INHABIT LARGE
STREAMS, RIVERS AND
RESERVOIRS WITH
SUBMERGED LOGS AND
ROCKS AND MODERATE
CURRENT.

THROUGHOUT MOST OF
MISSOURI, EXCEPT
NORTHWESTERN CORNER
OF
STATE, REPLACED BY
N. M. LOUISIANENSIS
IN EXTREME SOUTHERN
PART OF
STATE.*02*

NEWT, CENTRAL

OCCUR IN PONDS,
DITCHES AND SWAMPS.
EGGS ARE LAIN ON
AQUATIC VEGETATION.

OCCURS IN ALL PARTS
OF MISSOURI EXCEPT
NORTHWEST CORNER
01

SALAMANDER, CAVE

OCCUR ONLY IN AREAS

OCCURS IN THE OZARK

1

OF LIMESTONE
OUTCROPPINGS.
USUALLY
FOUND IN TWILIGHT
ZONE OF WET CAVES.
LAY EGGS IN CAVE
STREAMS, SPRINGS, OR
STREAMS OUTSIDE
CAVES.

SALAMANDER,
DARK-SIDED OCCUR UNDER ROCKS
NEAR STREAMS,
SPRINGS OR SEEPS IN
FORESTED AREAS. ALSO
OCCUR IN WET CAVES.
LAY EGGS UNDER
ROCKS OR IN GRAVEL
IN SHALLOW WATER.

SALAMANDER,
FOUR-TOED OCCUR IN LEAF
LITTER, UNDER ROCKS
AND LOGS IN
DECIDUOUS
FORESTS. LAY EGGS IN
MOSS OVERHANGING
WATER.

SALAMANDER, LONGTAIL INHABIT FORESTED
AREAS NEAR STREAMS,
SEEPS OR SPRINGS.
ALSO
FOUND IN TWILIGHT
ZONE OF WET CAVES.

PLATEAU *01*

OCCURS IN SOUTH MO
EXCEPT SOUTHEAST
PORTION OF STATE,
ALSO
EAST EDGE OF STATE
FROM JEFFERSON TO
MARION COUNTY *01*

OCCURS IN EASTERN
MISSOURI, WITH A
CONCENTRATION IN
THE ST. FRANCOIS
MOUNTAINS. A
POPULATION ALSO
OCCURS IN LINCOLN
COUNTY *02*
SOUTHEAST MO EXCEPT
MISSISSIPPI RIVER
LOWLANDS *01*

1OCCUR IN ST. FRANCOIS COUNTY

	GENERAL HABITAT	COMMENTS ON OCCURREN IN MISSOURI
SALAMANDER, NORTHERN SLIMY	OCCUR UNDER LEAF LITTER, ROCKS AND LOGS IN DAMP FORESTS.	OCCURS THROUGHOUT OZARK PLATEAU EXCEPT MISSISSIPPI LOWLAND *01*
SALAMANDER, SOUTHERN REDBACK	INHABITS DECIDUOUS FORESTS WITH DOWNED LOGS AND LEAF LITTER. ALSO OCCUR IN TWILIGHT ZONE OF WET CAVES.	OCCURS IN SOUTHEAST & SOUTH CENTRAL PART OF STATE EXCEPT THE MISSISSIPPI RIVER *01*
SALAMANDER, SPOTTED	INHABITS DAMP HARDWOOD FORESTS.	THROUGHOUT MO, EXCEPT NORTHERN ONE-THIRD OF STATE.*01*
TOAD, DWARF AMERICAN	PREFER ROCKY, WOODED AREAS, OFTEN ALONG FOREST EDGE. BREED IN SHALLOW STREAMS AND PONDS, TEMPORARY POOLS AND DITCHES.	IN GENERAL, MAY BE FOUND IN COUNTIES SOUTH OF MO RIVER *01*
COACHWHIP, EASTERN	OCCUR IN ROUGH, ROCKY TERRAIN. USE GRASSY AREAS ON TIMBERED HILLSIDES, CREEK VALLEYS AND PASTURES.	OCCUR IN THE OZARK REGION OF THE STATE *01*
LIZARD, EASTERN COLLARED	INHABIT CEDAR GLADES WITH LARGE FLAT ROCKS AND SPARSE GROUND VEGETATION.	
LIZARD, NORTHERN	OCCUR IN DRY OPEN	OZARK REGION, SE

FENCE	FORESTS OR ON OPEN TIMBERED HILLSIDES. NEST IN LOOSE SOIL. STUMPS, LOGS, AND FENCES PROVIDE BASKING SITES.	LOWLANDS, AND SW CEDAR GLADES *02,13*
RACER, EASTERN YELLOWBELLY	INHABIT OPEN FIELDS, BRUSHY AREAS, OPEN WOODLAND AND GRASSLAND.	OCCUR STATEWIDE EXCEPT FOR THE S.E. LOWLANDS OF STATE *01*
RACER, SOUTHERN BLACK	INHABIT SWAMPS NEAR LIMESTONE BLUFFS, AND BRUSHY BANKS OF DITCHES.	OCCUR IN S.E. LOWLANDS OF STATE *01*
SKINK, FIVE-LINED	INHABIT MOIST WOODLAND WITH DOWNED LOGS.	STATEWIDE EXCEPT EXTREME NORTH EDGE OF MO *01*
SKINK, GROUND	INHABIT WOODLAND AND CEDAR GLADES.	OCCURS IN SOUTH HALF OF MO *01*

1OCCUR IN ST. FRANCOIS COUNTY

	GENERAL HABITAT	COMMENTS ON OCCURREN IN MISSOURI
----- SNAKE, BLACK RAT	INHABIT DECIDUOUS FOREST, FOREST EDGE AND BRUSHY FIELDS. PREFER GOOD CANOPY COVER AND LITTER COVER.	STATEWIDE, EXCEPT SE MO LOWLAND.*02*
SNAKE, EASTERN GARTER	OCCUR IN GRASSLAND, FOREST, EDGE, FENCEROWS, AND ALONG BORDERS OF PONDS, STREAMS OR DITCHES.	OCCUR IN EASTERN MO, THE S.E. LOWLANDS, AND S. BORDER *01*
SNAKE, EASTERN HOGNOSE	OCCUR IN FOREST EDGE, FOREST, AND MARSHES. PREFER WELL-DRAINED SANDY SOIL.	SPECIES OCCURS STATEWIDE *01*.
SNAKE, MIDLAND BROWN	OCCUR IN MOIST WOODLAND, SWAMPS, FOREST EDGE, MARSHES AND PRAIRIES.	PRESUMABLY STATEWIDE. ALTHOUGH NEARLY ALL SPECIMENS ARE FROM SOUTHERN 1/2 OF STATE. ALL MO SPECIMENS ARE CONSIDERED INTERGRADES *01* PRIMARILY OCCUR SOUTH OF MO RIVER *10*
SNAKE, NORTHERN REDBELLY	INHABIT MOIST OPEN WOODLAND WITH ROTTEN LOGS AND HEAVY LEAF LITTER OR GROUND DEBRIS.	OCCURS STATE-WIDE *05*
KINGSSNAKE, PRAIRIE	OCCUR IN OPEN FIELDS, GRASSLAND, ROCKY HILLSIDES AND OPEN WOODLANDS.	OCCURS STATEWIDE EXCEPT FOR S.E. LOWLAND *01*
SNAKE, PRAIRIE RINGNECK	PREFER ROCKY HILLSIDES IN OPEN WOODLAND. ALSO OCCUR ON ROCKY OUTCROPS IN PASTURE AND ON TALUS.	STATE-WIDE EXCEPT FOR EXTREME NORTH *05*
SNAKE, ROUGH GREEN	INHABITS BRUSH AND SHRUBS AT FOREST EDGE ADJACENT TO	

KINGSSNAKE, SPECKLED

WATER.

GENERALLY FOUND IN
MOIST OPEN WOODLAND,
WOODLAND EDGE,
GRASSLAND NEAR
WOODED AREAS AND
LIMESTONE LEDGES.
INHABIT WOODLANDS.

OCCURS STATE-WIDE

05

SNAKE, WESTERN EARTH

OCCURS IN SOUTHERN
HALF OF STATE *01*

10 OCCUR IN ST. FRANCOIS COUNTY

GENERAL HABITAT

COMMENTS ON OCCURREN
IN MISSOURI

TURTLE, ALLIGATOR
SNAPPING

OCCUR IN SWAMPS,
MARSHES, SLOUGHS,
STREAMS, PONDS,
LAKES
AND RESERVOIRS WITH
MUD OR SILT BOTTOM,
SLOW CURRENT,
MODERATE AQUATIC
VEGETATION AND DEEP
WATER.

WIDESPREAD DRAINAGE
AND CHANNELIZATION
IN SE MO HAS
ELIMINATED MUCH OF
THE STATE'S FORMER
HABITAT. *03*

TURTLE, THREE-TOED
BOX

OCCUR IN OPEN
WOODLANDS, BRUSHY
FIELDS AND PASTURE,
USUALLY
FOUND NEAR WATER.

STATEWIDE EXCEPT
EXTREME N. AND NW.
CORNER OF STATE *01,
02* COMMON IN OZARK
REGION, LESS COMMON
ELSEWHERE *01*
RARE TRANSIENT,
CASUAL WINTER
RESIDENT *01*

BLACKBIRD, BREWER'S

OCCURS IN OPEN AREAS
SUCH AS PASTURES,
CROP FIELDS,
ROADSIDES
OR ORCHARDS.
INHABIT WETLANDS
WITH EMERGENT
VEGETATION, AND
OCCASIONALLY
UPLAND PASTURES.
TERRITORY USUALLY
HAS AT LEAST ONE
TREE >5 M
TALL.

COMMON SUMMER
RESIDENT, UNCOMMON
WINTER RESIDENT *01*

BLACKBIRD,
RED-WINGED

BLUEBIRD, EASTERN

OCCUR IN OPEN
GRASSLAND, ABANDONED
FIELDS AND MARGINS
OF THIN
WOODLANDS WHERE
GROUND COVER IS LOW
AND SPARSE. REQUIRE
CAVITY
TREES OR NEST BOXES.
PREFERRED DBH OF
CAVITY TREES IS 6-8
IN.

COMMON SUMMER &
UNCOMMON WINTER
RESIDENT - STATEWIDE
*02,
05, 06*

BUFFLEHEAD

OCCURS IN PONDS,
LAKES, RESERVOIRS
AND DITCHES WITH
OPEN
(ICE-FREE) WATER
4-15 FEET DEEP FOR
FORAGING.

UNCOMMON WINTER
RESIDENT, FREQUENT
TRANSIENT *03*

10 OCCUR IN ST. FRANCOIS COUNTY

GENERAL HABITAT

COMMENTS ON OCCURREN
IN MISSOURI

BUNTING, INDIGO	INHABITS FOREST EDGE, BRUSHY FIELDS, THICKETS AND YOUNG REGENERATION AREAS. BRUSHY VEGETATION IS IMPORTANT. STEM DENSITIES SHOULD BE 1-2 STEMS PER SQUARE YARD.	COMMON SUMMER RESIDENT-STATEWIDE. *02*
CARDINAL, NORTHERN	OCCURS IN OPEN WOODLANDS, GROVES, PARKS, FOREST EDGE, AND RESIDENTIAL AREAS WITH DENSE, TANGLED UNDERGROWTH, >55% GROUND COVER, AND GROUND VEGETATION >.10 M TALL.	COMMON PERMANENT RESIDENT - STATEMENT *02*
CATBIRD, GRAY	INHABITS DENSE THICKETS (SHRUBS, BRIARS, VINES) BORDERING WATER IN LARGE FOREST STANDS. ALSO OCCURS IN DENSE SHRUBS AND THICKETS IN RESIDENTIAL AREAS.	COMMON SUMMER RESIDENT, ACCIDENTAL WINTER RESIDENT *01*
CHAT, YELLOW-BREASTED	OCCUR IN OLD FIELDS, HEDGEROWS, THICKETS, WOODLAND EDGES AND FOREST CLEARINGS WITH YOUNG GROWTH, WITH INTERMEDIATE TO TALL GROUND VEGETATION, HIGH SHRUB DENSITY AND TALL, OPEN CANOPY.	SUMMER RESIDENT, UNCOMMON-SOUTH, RARE-NORTH.*02*
CHICKADEE, CAROLINA	INHABIT DECIDUOUS AND CONIFEROUS FORESTS, FOREST EDGE AND RURAL WOODLOTS WITH TREES 4-12 IN. DBH WITH DECAYED CORES. PREFER CANOPY CLOSURE >70%, SUBCANOPY 40-60%.	COMMON PERMANENT RESIDENT - SOUTHERN HALF OF STATE.*02*
CHUCK-WILL'S WIDOW	OCCUR IN OAK-PINE FOREST WITH LITTLE OR NO UNDERGROWTH OR GROUND COVER.	UNCOMMON SUMMER RESIDENT *01*
1OCCUR IN ST. FRANCOIS COUNTY	GENERAL HABITAT	COMMENTS ON OCCURREN IN MISSOURI
COWBIRD, BROWN-HEADED	OCCUR IN OLD FIELDS, WOODLAND, EDGE, CROP FIELDS AND PASTURE. USE SNAGS FOR PERCHES TO LOCATE HOST NESTS. FORAGE IN OPEN AREAS WITH SHORT GRASS AND WEEDS.	COMMON SUMMER RESIDENT, RARE (SOUTHERN) WINTER RESIDENT *01*
CRANE, SANDHILL	OCCUR IN GRASSLAND	TRANSIENT CASUAL,

CROSSBILL, RED	OR CROP FIELDS ADJACENT TO WATER SUCH AS MARSHES, SLOUGHS, PONDS, LAKES, RESERVOIRS OR STREAMS. INHABIT CONIFEROUS FORESTS.	WINTER RESIDENT ACCIDENTAL *01*
CROW, AMERICAN	INHABIT WOODLANDS AND WOODLAND EDGE. FOREST STANDS SHOULD BE AT LEAST .2 HA. ABUNDANCE POSITIVELY CORRELATED WITH STAND SIZE AND WITH CANOPY HEIGHT.	RARE WINTER RESIDENT, CASUAL SUMMER VISITANT *01* COMMON PERMANENT RESIDENT - STATEWIDE.*02*
CUCKOO, BLACK-BILLED	INHABIT INTERIOR AND EDGE OF FOREST STANDS > 4 HA. PREFER AREAS WITH LOW, DENSE SHRUBBY VEGETATION.	RARE SUMMER RESIDENT *01*
CUCKOO, YELLOW-BILLED	INHABIT UPLAND HARDWOODS, RIPARIAN FOREST, THICKETS, FOREST EDGE AND RESIDENTIAL AREAS. CANOPY, SUBCANOPY AND HERBACEOUS COVER MAY VARY BUT PREFER < 15% BARE GROUND AND FOREST STANDS > 1.2 HA.	COMMON SUMMER RESIDENT *01*

1 OCCUR IN ST. FRANCOIS COUNTY

	GENERAL HABITAT	COMMENTS ON OCCURREN IN MISSOURI
DICKCISSEL	OCCUR IN GRASSLAND, FIELD BORDERS, GRASSY ROADSIDES AND EARLY SUCCESSIONAL STAGE ABANDONED FIELDS. WOODY INVASION SHOULD BE <10%. DENSE GROUND VEG. WITH >95% HERB. COVER IS PREFERRED. OCCUR IN CROP FIELDS OR OTHER EARLY OPENLAND SUCCESSIONAL STAGES WITH ANNUAL SEED PRODUCING PLANTS, SPARSE HERBACEOUS GROUND COVER AND LITTLE LITTER. FENCEROWS, FOREST EDGE AND	COMMON SUMMER RESIDENT, ACCIDENTAL WINTER RESIDENT *01*
DOVE, MOURNING		COMMON SUMMER RES., RARE WINTER RES. *01*. COMMON MARCH THROUGH SEPT. AND OVER-WINTER IN FLOCKS (ISOLATED), ESP. IN SOUTH MO *05*

DOVE, ROCK

SCATTERED TREES
PROVIDE NEST SITES.
FORAGE IN GRAIN
FIELDS AND WASTE
LAND. NEST ON CLIFF,
LEDGES,
BUILDINGS, UNDER
BRIDGES, AND ON
OTHER MAN-MADE
STRUCTURES.

COMMON PERMANENT
RESIDENT *01*

DUCK, AMERICAN BLACK

INHABIT MARSHES,
SWAMPS AND OTHER
INLAND WETLANDS WITH
MUD
OR SILT BOTTOMS,
SHALLOW WATER, AND
MODERATELY DENSE
AQUATIC
VEGETATION
INTERSPERSED WITH
OPEN WATER.

WINTER RESIDENT,
BETWEEN DEC. 15 &
FEB. 20., UNCOMMON
EAST
SUMMER RESIDENT
EXTREMELY RARE. A
RARE BREEDER IN MO
01,15

DUCK, RING-NECKED

OCCUR IN MARSHES,
SWAMPS, SLOUGHS,
PONDS, LAKES AND
RESERVOIRS. SEEM TO
PREFER SHALLOW, ACID
MARSHES.

COMMON TRANSIENT,
RARE WINTER
RESIDENT, ACCIDENTAL
SUMMER
VISITANT IN NW MO
01. COMMON WINTER
RES. IN BOOTHEEL IN
SOME YEARS
03

10OCCUR IN ST. FRANCOIS COUNTY

GENERAL HABITAT

DUCK, RUDDY

OCCUR IN MARSHES,
PONDS, LAKES AND
RESERVOIRS WITH OPEN
WATER
IN WINTER.

COMMENTS ON OCCURREN
IN MISSOURI

COMMON TRANSIENT,
RARE WINTER
RESIDENT, CASUAL
SUMMER
VISITANT *01*
COMMON SPRING & FALL
MIGRANT, SUMMER
RESIDENT BREEDER
52

DUCK, WOOD

OCCUR IN MATURE TO
OLD GROWTH LOWLAND
HARDWOODS, WOODED
SWAMPS, BRUSHY
SLOUGH OR PERMANENT
MARSHES WITH WOODY
BORDERS.
PREFERRED WATER
DEPTH 2-6 INCHES.
MAST &
SEED-PRODUCING TREES
AND SEED PRODUCING
EMERGENTS ARE
IMPORTANT FOOD
SOURCES.

EGRET, CATTLE

REQUIRE CAVITY TREES
(>12 IN. DBH) OR
NEST BOXES.
PREFER AREAS OF
WILLOW AND
BUTTONBUSH IN
MARSHES, SWAMPS,
WET PRAIRIES AROUND
LAKES AND PONDS.
VEGETATION AT NEST
SITES
AVERAGES 4 M TALL,
NEST TREES AVERAGE 6
CM DBH. OTEN FORAGE

LIKELY TO OCCUR
STATEWIDE *01* BUT
NOT COMMON *02*

EGRET, GREAT	WITH GRAZING LIVESTOCK. INHABIT SWAMPS, BRUSHY LAKE BORDERS AND RIPARIAN WOODLANDS. PREFER VEGETATION AVERAGE 5.73 M TALL AND NEST TREE AVERAGE 24 CM DBH.	COMMON SUMMER RESIDENT *01*
GOLDFINCH, AMERICAN	INHABIT FOREST EDGE, HEDGEROWS, BRUSHY OR WEEDY FIELDS, SHRUBBY SWAMPS, ORCHARDS AND CROPLAND. PREFER LITTER < .03 M, AND GROUND VEGETATION > 80% AND > .4 M TALL.	COMMON PERMANENT RESIDENT - STATEWIDE. *02*
10CCUR IN ST. FRANCOIS COUNTY		
	GENERAL HABITAT	COMMENTS ON OCCURREN IN MISSOURI
FLICKER, NORTHERN	INHABIT FORESTS AND FOREST EDGE WITH TALL CANOPIES. SNAGS ARE REQUIRED. PREFER NEST TREES AVERAGE 37-62 CM DBH. FORAGE IN CROPLAND, SHRUBBY AREAS AND PASTURES. OCCUR IN LOWLAND DECIDUOUS FORESTS OR UPLAND RAVINES NEAR STREAMS. PREFER LARGE FOREST STANDS WITH CANOPY CLOSURE 70-100% AND DENSE FOLIAGE .3 TO 1 M ABOVE GROUND.	COMMON PERMANENT RESIDENT *03*
FLYCATCHER, ACADIAN	OCCURS IN FORESTS, FOREST EDGE, SWAMPS AND ORCHARDS. PREFER TALL CANOPY AND PRESENCE OF LARGE (30 CM DBH) TREES. INHABITS DECIDUOUS FORESTS, GLADES AND GRASSLAND WITH SCATTERED SHRUBS AND TREES.	UNCOMMON SUMMER RES. IN NORTH MO, COMMON IN SOUTH MO *01*
FLYCATCHER, GREAT CRESTED	INHABIT SHRUBBY THICKETS ALONG STREAMS IN RIPARIAN FORESTS. PREFER LOW, OPEN CANOPY (5-30%), > 90% GROUND VEGETATION .4 TO .7 M TALL, AND > 60% LITTER COVER.	COMMON SUMMER RESIDENT. *02*
FLYCATCHER, OLIVE-SIDED	PREFERS LOW WET THICKETS BORDERING SWAMPS, STREAMS, PONDS, LAKES OR RESERVOIRS.	RARE TRANSIENT - STATEWIDE
FLYCATCHER, WILLOW		UNCOMMON SUMMER RESIDENT IN WEST, RARE-EAST.*02*
FLYCATCHER, YELLOW-BELLIED		TRANSIENT, RARE *01*.

GADWALL

OCCURS IN MARSHES,
SWAMPS, SLOUGHS,
STREAMS, PONDS,
LAKES
AND RESERVOIRS. USE
CROPLAND FOR
FEEDING.

TRANSIENT, COMMON,
WINTER RESIDENT,
UNCOMMON, SUMMER
VISITANT, CASUAL,
RARE IN THE WESTERN
PART OF STATE *01*

1OCCUR IN ST. FRANCOIS COUNTY

GENERAL HABITAT

GNATCATCHER,
BLUE-GRAY

PREFER RIPARIAN
WOODLANDS > 15 HA
WITH CLOSED CANOPIES
AND
DENSE FOLIAGE.
RCOGEN = **

GOOSE, CANADA

REFERENCE : 04 05 09
NEST ON ISLANDS OR
ARTIFICIAL NESTING
STRUCTURES IN LAKES,
PONDS, OXBOWS OR
MARSHES NEAR UPLAND
FOOD SOURCES. IN
WINTER
FEED IN OPEN CROP
FIELDS OR
GRASSLANDS. OPEN
WATER AND
PROTECTION FROM
HUNTING PRESSURE ARE
REQUIRED.

COMMENTS ON OCCURREN
IN MISSOURI

COMMON SUMMER
RESIDENT - STATEWIDE
02 LESS ABUNDANT
IN
NORTHERN
COUNTIES.*03*

MIGRANTS LIKELY TO
OCCUR THROUGHOUT
STATE, RESIDENT
POPULATION
OCCURS IN ANDREW,
BARRY, BATES,
BOLLINGER, BOONE,
BUCHANAN,
CALDWELL, CALLAWAY,
CASS, CEDAR,
CHARITON, CHRISTIAN,
CLAY
CLINTON, COLE, DADE,
DAVISS, DEKALB,
FRANKLIN, GASCONADE,
GENTRY, GREENE,
HARRISON, HENRY,
HOLT, HOWARD,
JACKSON,
JASPER, JOHNSON,
KNOX, LAFAYETTE,
LEWIS, LINCOLN,
LINN,
LIVINGSTON,
MCDONALD, MACON,
MARION, MERCER,
MONTGOMERY,
NEWTON, OSAGE,
OZARK, PLATTE, POLK,
PUTNAM, RALLS,
RANDOLPH, ST.
CHARLES, ST. CLAIR,
ST. LOUIS, SALINE,
SCHUYLER, SHELBY,
STODDARD, STONE,
SULLIVAN, TANEY,
VERNON, WARREN,
WAYNE, & WORTH
COUNTIES *07,08*.
COMMON PERMANENT
RESIDENT, UNCOMMON
(COMMON IN S.E.)
WINTER COCRST =
RESIDENT *01*

GRACKLE, COMMON

OCCUR IN MARSHES,
THICKETS, CROPLAND,
DECIDUOUS AND
CONIFEROUS
WOODLAND AND
RESIDENTIAL AREAS.

1OCCUR IN ST. FRANCOIS COUNTY

GENERAL HABITAT

COMMENTS ON OCCURREN
IN MISSOURI

GROSBEAK, BLUE

INHABIT OLD FIELDS,
EDGES, SCRUBBY
THICKETS, OPEN
GROVES AND
HEDGEROWS WITH
SHALLOW WATER, DENSE
GROUND VEGETATION
(>95%)

UNCOMMON SUMMER
RESIDENT-SOUTH,
RARE-NORTH. *02*

GROSBEAK, EVENING

AND A LOW NUMBER OF
WOODY STEMS.
USUALLY OCCUR IN
OPEN CONIFEROUS
FORESTS OR ON
HILLSIDES COVERED
WITH AN OPEN GROWTH
OF RED CEDARS.

RARE WINTER RESIDENT
IN EAST MO, CASUAL
WINTER RES. IN
WEST MO *01*

GROSBEAK,
ROSE-BREASTED

PREFER LARGE STANDS
OF SECOND-GROWTH
WOODLANDS WITH
GROUND
VEGETATION < .4 M,
CANOPY HEIGHT 12-28
M, OFTEN ALONG EDGES
OF

COMMON TRANSIENT,
UNCOMMON SUMMER RES.
IN NORTH MO,
ACCIDENTAL WINTER
RES. *01*

GULL, HERRING

SWAMPS OR STREAMS.
ARE ASSOCIATED WITH
MARSHES, STREAMS,
PONDS, LAKES AND
RESERVOIRS.

WINTER RESIDENT,
CASUAL (EAST),
UNCOMMON (WEST),
SUMMER
VISITANT, ACCIDENTAL
01.

HAWK, BROAD-WINGED

INHABITS RIPARIAN
WOODLANDS WITH
SNAGS.

POSSIBLE STATEWIDE
DISTRIBUTION *02*

HAWK, COOPER'S

OCCURS IN BOTH PINE
AND OAK-HICKORY
FOREST. TYPICALLY
INHABIT
YOUNG, DENSE STANDS
WITH HIGH CANOPY

LIKELY STATEWIDE,
EXCEPT DURING
NESTING SEASON,
REPORTED
NESTING IN FEW

1 OCCUR IN ST. FRANCOIS COUNTY

GENERAL HABITAT

COMMENTS ON OCCURREN
IN MISSOURI

HARRIER, NORTHERN *

SHALLOW MARSHES.
HERBACEOUS
VEGETATION SHOULD BE
DENSE, WITH
NEARLY 100% CANOPY
COVER, AND REACH
HEIGHT OF 10 IN. BY
MID-MAY.

SOME NESTING IN SW
AND NW REGIONS OF
STATE *02*

HAWK, RED-SHOULDERED

PREFERS EXTENSIVE
MATURE FLOODPLAIN
FORESTS (250-625
ACRES),
WITH 90-95% CANOPY
COVER, WITHIN 1/2
MILE OF PERMANENT
WATER.
PREFER NEST TREES >
80 FT. TALL AND > 22
IN. DBH.

OCCUR IN SE HALF OF
STATE *01*

HAWK, RED-TAILED

INHABIT SEMI-OPEN
WOODLANDS AND UPLAND
GROVES INTERSPERSED
WITH
CROPLAND AND

OCCURS STATEWIDE
01. POPULATION IN
CENTRAL MISSOURI IS
APPARENTLY
EXPANDING *69*

HAWK, ROUGH-LEGGED PASTURE. PREFERENCES
FOREST STANDS <.4 HA
WITH HIGH CANOPIES.
OCCURS IN MARSHY
FIELDS, WET MEADOWS,
BOGS, AND RIPARIAN
FIELDS AND
PASTURES WITH LARGE
LONE TREES FOR
PERCHES.

HAWK, SHARP-SHINNED PREFERRED NESTING
HABITAT DENSE,
EVEN-AGED STANDS OF
SHORTLEAF
PINE > 15 ACRES IN
SIZE, WITH 80% CROWN
CLOSURE AND AVG. DBH
6-12 IN., SURROUNDED
BY DECIDUOUS FOREST.

POSSIBLE STATEWIDE
DISTRIBUTION DURING
FALL, WINTER, AND
SPRING *01*

POSSIBLE STATEWIDE
DISTRIB. DURING
WINTER BUT FEW
NESTING
INDIVIDUALS DURING
SUMMER *01*

10 OCCUR IN ST. FRANCOIS COUNTY

	GENERAL HABITAT	COMMENTS ON OCCURREN- IN MISSOURI
HERON, GREAT BLUE	NEST IN MATURE TO OLD GROWTH BOTTOMLAND FORESTS, PREFERABLY IN TRACTS > 250 ACRES. FORAGE IN MARSHES, BACKWATERS, STREAMS, DITCHES AND ALONG POND MARGINS.	OCCUR STATEWIDE, BUT DON'T NEST IN EVERY COUNTY *08*
HERON, GREEN-BACKED	PREFER NONFORESTED WETLANDS OF AT LEAST 20 ACRES WITHIN A WETLAND COMPLEX THAT INCLUDES FORESTED WETLANDS. STABLE WATER LEVELS ARE IMPORTANT.	COMMON SUMMER RESIDENT *01*
HERON, LITTLE BLUE	INHABIT MARSHES AND SWAMPY, BRUSHY EDGES OF PONDS, LAKES AND STREAMS WITH SHALLOW WATER.	SUMMER RESIDENT, MORE COMMON IN EASTERN PART OF STATE *01*
HERON, YELLOW-CROWNED NIGHT	OCCUR IN MATURE SECOND-GROWTH LOWLAND FOREST AND SWAMPS WITH TALL CANOPY, GOOD CANOPY COVER AND RELATIVELY SPARSE SUBCANOPY.	UNCOMMON SUMMER RESIDENT
HUMMINGBIRD, RUBY-THROATED	INHABITS MIXED WOODLANDS, ORCHARDS AND SHADE TREES WITH TALL CANOPY AND GOOD CANOPY COVER.	COMMON SUMMER RESIDENT - STATEWIDE
JAY, BLUE	INHABITS OPEN WOODLANDS, FOREST EDGE, OLD FIELDS, AND RESIDENTIAL AREAS. PREFERENCES >70% CANOPY COVER, DENSE	COMMON PERMANENT RESIDENT - STATEWIDE.*02*

FOLIAGE 2-3 M ABOVE
GROUND,
AND SPARSE FOLIAGE
<1 M ABOVE GROUND.

10CCUR IN ST. FRANCOIS COUNTY

GENERAL HABITAT

COMMENTS ON OCCURREN
IN MISSOURI

KESTREL, AMERICAN

INHABIT OPEN AREAS
SUCH AS FARMLAND AND
PASTURE WITH
SCATTERED CLUMPS
OF TREES. REQUIRE A
PERCH (TREE, FENCE
POST, UTILITY POLE)
TO HUNT

COMMON PERMANENT
RESIDENT *01*

KILLDEER

FROM. NEST TREES
AVERAGE 16 M TALL
AND 12 INCHES DBH.
OCCUR IN PASTURES,
MEADOWS, AND
CULTIVATED FIELDS,
USUALLY ADJACENT
TO WATER. PREFER
AREAS WITH LOW,
SPARSE GROUND
VEGETATION.

COMMON SUMMER
RESIDENT STATEWIDE,
RARE WINTER RESIDENT
IN
SOUTH MO *01*

KINGBIRD, EASTERN

OCCURS IN OPEN
WOODLANDS, BRUSHY
PASTURES, ORCHARDS,
WOODLAND EDGE
AND OLD FIELDS WITH
DENSE LITTER COVER
(>85%). OFTEN NEST
IN DEAD
TREES.

COMMON SUMMER
RESIDENT - STATEWIDE
02

KINGFISHER, BELTED

OCCURS ALONG BANKS
OF PONDS, LAKES,
RESERVOIRS, SWAMPS
OR STREAMS
WITH LITTLE OR NO
CURRENT. PREFERS
SHALLOW, CLEAR WATER
WITH LITTLE
VEGETATION. NESTS IN
DIRT BANKS. SNAGS
ARE BENEFICIAL.

PERMANENT RESIDENT -
STATEWIDE. *02*

KITE, MISSISSIPPI

OCCUR IN SWAMPS AND
LARGE TRACTS OF
BOTTOMLAND FORESTS
WITH TALL
TREES. NEST TREES
AVERAGE 29 INCHES
DBH AND 121 FEET
TALL.

OCCURRENCE USUALLY
ASSOC. WITH EASTERN
BORDER AND S.E.
CORNER OF STATE.
RARELY IN S.W.
CORNER *01*

10CCUR IN ST. FRANCOIS COUNTY

GENERAL HABITAT

COMMENTS ON OCCURREN
IN MISSOURI

LARK, HORNED

INHABIT OPEN AREAS
HAVING BARE GROUND
INTERSPERSED WITH

COMMON PERMANENT
RESIDENT *01*

MALLARD

SHORT, SPARSE
VEGETATION. REQUIRE
<84% HERBACEOUS
COVER, LITTER DEPTH
< .36 INCHES,
AND HERBACEOUS COVER
< 4 INCHES TALL.
IDEAL WINTER HABITAT
CONSISTS OF OPEN
WETLANDS WITH
ABUNDANT
ANNUAL
SEED-PRODUCING
PLANTS, NEAR
FORESTED WETLANDS
DOMINATED
BY MAST-PRODUCING
HARDWOODS. PREFERRED
NESTING HABITAT:
GRASSY
AREAS OR HAYFIELDS
WITHIN 1 MILE OF
WATER. EMERGENT
WETLANDS
WITH STABLE WATER
LEVELS ARE IMPORTANT
DURING SUMMER.

COMMON WINTER
RESIDENT, COMMON
TRANSIENT, RARE
SUMMER
RESIDENT *01*

MARTIN, PURPLE

PRIMARILY NEST IN
BIRDBOUSES IN
RESIDENTIAL AREAS OR
FARMYARDS.
REQUIRE OPEN AREAS
FOR FORAGING.

COMMON SUMMER
RESIDENT -
STATEWIDE.*02*

MEADOWLARK, EASTERN

OCCUR IN GRASSLAND
WITH LITTER DEPTH <
2 CM, <35% SHRUB
CANOPY, AND
96% GRASS COVER 4-30
INCHES TALL.

STATEWIDE PERMANENT
RESIDENT *21,22*

MOCKINGBIRD,
NORTHERN

OCCURS IN PASTURES
WITH SCATTERED
TREES, OPEN
WOODLAND, FOREST
EDGE AND RESIDENTIAL
AREAS. PREFER DENSE
EVERGREENS FOR
NESTING
BUT ALSO USE SHRUBS,
VINES AND HEDGES.

UNCOMMON SUMMER RES.
IN NW MO, COMMON
ELSEWHERE. UNCOMMON
WINTER RES. IN SOUTH
MO *01*

OCCUR IN ST. FRANCOIS COUNTY

GENERAL HABITAT

NIGHTHAWK, COMMON

REQUIRE FLAT SURFACE
WITH NO VEGETATION
FOR NESTING. MAY USE
PLOWED FIELDS,
BURNED AREAS, FOREST
OPENINGS OR GRAVEL
ROOFS.

COMMENTS ON OCCURREN
IN MISSOURI

UNCOMMON SUMMER RES.
IN SOUTH, RARE
SUMMER RES. IN NORTH
01

NUTHATCH,
RED-BREASTED

OCCUR IN CONIFEROUS
OR MIXED FOREST
STANDS > 2.2 HA.

UNCOMMON WINTER
RESIDENT, CASUAL
SUMMER RESIDENT *01*
COMMON PERMANENT
RESIDENT *01*

NUTHATCH,
WHITE-BREASTED

OCCUR IN DRY MATURE
OR OLD GROWTH
DECIDUOUS,
CONIFEROUS OR MIXED
FOREST STANDS > 3 HA
WITH HIGH CANOPY

ORIOLE, NORTHERN	<p>CLOSURE, 51% SHRUB COVER, AND SPARSE HERBACEOUS VEGETATION. REQUIRE CAVITY TREES > 12 IN. DBH. INHABIT SECOND-GROWTH DECIDUOUS FORESTS WITH AT LEAST 80% CANOPY, AND SUBCANOPY AT LEAST 45%.</p>	<p>COMMON SUMMER RESIDENT, CASUAL WINTER RESIDENT *01*</p>
ORIOLE, ORCHARD		
OVENBIRD	<p>PREFER LARGE CONTIGUOUS TRACTS OF MATURE UPLAND HARDWOODS, WITH SAWTIMBER SIZE CLASS TREES. MODERATE TO DENSE WOODY UNDERSTORY IS PREFERRED. REQUIRE DENSE GROUND VEGETATION AND ABUNDANT LITTER. INHABIT DECIDUOUS FOREST WITH OPEN UNDERSTORY AND SNAGS OR CAVITY TREES > 20 IN. DBH.</p>	<p>COMMON SUMMER RESIDENT *01* COMMON SUMMER RESIDENT *01*</p>
OWL, BARRED		<p>COMMON PERMANENT RESIDENT STATEWIDE *31*</p>
10 OCCUR IN ST. FRANCOIS COUNTY		
	GENERAL HABITAT	COMMENTS ON OCCURREN IN MISSOURI
OWL, GREAT HORNED	<p>OCCUR IN MIXED DECIDUOUS AND CONIFEROUS FOREST AND SWAMPS. PREFER CLOSED CANOPIES. FORAGE IN CROPLAND AND OLD FIELDS. PREFER NEST TREES > 12 IN. DBH. INHABIT OLD FIELDS, FOREST EDGE, AND SMALL FOREST STANDS NEAR</p>	<p>COMMON PERMANENT RESIDENT STATEWIDE *27*</p>
OWL, EASTERN SCREECH	<p>WATER. REQUIRE SNAGS OR CAVITY TREES (12 IN. DBH) FOR NESTING. PREFER SPARSE FOLIAGE WITHIN 1 M FROM GROUND.</p>	<p>LIKELY TO OCCUR STATE-WIDE *28*</p>
PARULA, NORTHERN	<p>PREFER MATURE FOREST TRACTS OF AT LEAST 250 ACRES WITH >80% CANOPY CLOSURE AND 75-80% SUBCANOPY, WITHIN 1/4 MILE OF WATER. RIPARIAN CORRIDORS SHOULD BE AT LEAST</p>	<p>COMMON SUMMER RESIDENT - STATEWIDE *02* RARE IN CERTAIN NW COUNTIES. *03*</p>

PEWEE, EASTERN WOOD- 100 FT. WIDE.
OCCURS IN OLD
FIELDS, FIELD EDGES,
CLEARINGS AND
WOODLAND.

COMMON SUMMER
RESIDENT.*02*

PREFERS SPARSE,
INCOMPLETE CANOPY,
AND GROUND
VEGETATION
< 4 M.

PHOEBE, EASTERN OCCUR ALONG FOREST
EDGE. REQUIRE A
SHELF OR WALL FOR
NEST
PLACEMENT (BLUFF,
BRIDGE, BUILDING).
NEST NEAR WOODY
COVER
AND WATER.

UNCOMMON SUMMER
RESIDENT, CASUAL
WINTER RESIDENT - S.
02

1OCCUR IN ST. FRANCOIS COUNTY

GENERAL HABITAT

COMMENTS ON OCCURREN- IN MISSOURI

PINTAIL, NORTHERN

INHABIT INLAND
WETLANDS WITH
SHALLOW WATER AND
MODERATELY
DENSE AQUATIC
VEGETATION. FORAGE
IN CROP FIELDS OR
STUBBLE,
AND IN WATER 14-21
CM DEEP.

TRANSIENT, COMMON,
WINTER RESIDENT,
DEC. 15 & FEB. 20.
UNCOMMON, SUMMER
RESIDENT, CASUAL,
N.W. USUALLY A
BREEDER *01*

BOBWHITE, NORTHERN

GOOD INTERSPERSION
OF GRASSLAND,
CROPLAND, BRUSHY
COVER AND
WOODLAND PROVIDE
OPTIMUM HABITAT.
EARLY SUCCESSIONAL
STAGES
WITH ABUNDANT ANNUAL
WEED SEED PRODUCTION
ARE MOST IMPORTANT.
REQUIRE WOODY ESCAPE
AND WINTER COVER.

OCCURS STATEWIDE
01,24

REDHEAD

OCCUR IN MARSHES,
SLOUGHS, PONDS,
LAKES, RESERVOIRS
AND STREAMS
WITH ABUNDANT
SUBMERGED AQUATIC
VEGETATION AND OPEN
(ICE-FREE)

COMMON TRANSIENT
03, RARE WINTER
RES., CASUAL SUMMER
VISITANT IN NW MO
01. APPROX. 300
REDHEADS WINTER IN
MO *15*

REDPOLL, COMMON

WATER. FORAGE IN
WATER < 6 FEET DEEP.
INHABIT BRUSHY
PASTURES, WEEDY
FIELDS AND THICKETS.
FORAGE IN
CROPLAND.

RARE WINTER RESIDENT
IN NW MO, CASUAL
WINTER RES.
ELSEWHERE IN STATE
01

ROBIN, AMERICAN

INHABIT OPEN
WOODLANDS, EDGE,
CLEARINGS, OLD
FIELDS, ORCHARDS,
AND RESIDENTIAL
AREAS.

COMMON SUMMER &
UNCOMMON WINTER
RESIDENT-STATEWIDE.*
02*

SCAUP, GREATER

OCCUR IN MARSHES,
STREAMS, PONDS,
LAKES OR RESERVOIRS
WITH SUBMERGED
AQUATIC VEGETATION
AND OPEN (ICE-FREE)
WATER.

FREQUENT TRANSIENT
IN EAST MO, UNCOMMON
TRANSIENT IN WEST
MO, CASUAL WINTER
RES., ACCIDENTAL
SUMMER VISITANT IN
NORTHWEST MO
03

1OCCUR IN ST. FRANCOIS COUNTY

GENERAL HABITAT

COMMENTS ON OCCURREN
IN MISSOURI

SCAUP, LESSER

OCCUR IN MARSHES,
STREAMS, PONDS,
LAKES OR RESERVOIRS
WITH
SUBMERGED AQUATIC
VEGETATION AND OPEN
(ICE-FREE) WATER.

COMMON TRANSIENT,
UNCOMMON WINTER
RESIDENT, RARE
SUMMER
VISITANT *01*

SHOVELER, NORTHERN

OCCURS IN INLAND
WETLANDS WITH
EMERGENT VEGETATION.
FLOODED
CROPLAND PROVIDES
FORAGING HABITAT.

TRANSIENT, COMMON,
WINTER RESIDENT,
RARE, SUMMER
VISITANT,
CASUAL. *02*

SHRIKE, LOGGERHEAD

INHABITS OPEN
COUNTRY WITH
SCATTERED TREES AND
SHRUBS, FENCEROWS
AND HEDGEROWS.
PREFERS AREAS WITH
THORNY TREES AND
SHORT
HERBACEOUS
VEGETATION. REQUIRE
ELEVATED FORAGING
PERCHES.

COMMON PERMANENT
RESIDENT *01*

SPARROW, GRASSHOPPER

OCCUR IN DRY,
WELL-DRAINED OPEN
GRASSLAND WITH SHORT
GRASS,
INHABIT GRASSLAND
WITH SHORT (4-12
IN.) GRASS, SHALLOW
LITTER
COVER, AND 75-100%
GRASS COVER. AVOID
AREAS WITH >35%
SHRUB
COVER.

COMMON SUMMER
RESIDENT - STATEWIDE
02

SPARROW, HARRIS'

OCCUR IN THICK
UNDERBRUSH AT EDGE
OF WOODLAND OR
STREAMS, AND IN
WEEDY THICKETS.

COMMON WINTER RES.
IN WEST MO, RARE
WINTER RES. IN EAST
MO *01*

SPARROW, HENSLOW'S

OCCUR IN GRASSLAND,
OLD FIELDS AND
CROPLAND. PREFER
AREAS
DOMINATED BY DENSE
GRASSES AND SEDGES
WITH DENSE LITTER
COVERAGE.
PREFER HERBACEOUS
VEGETATION 1-2 FEET
TALL.

RARE SUMMER RESIDENT
IN N. & SW PORTIONS
OF MO.*02*

1OCCUR IN ST. FRANCOIS COUNTY

	GENERAL HABITAT	COMMENTS ON OCCURRENCE IN MISSOURI
SPARROW, HOUSE	OCCURS IN A VARIETY OF HABITATS, INCLUDING CROPLAND, GRASSLAND, EDGE AND OLD FIELDS. IS OFTEN ASSOCIATED WITH RESIDENTIAL AREAS OR PARKS.	PERMANENT RESIDENT, COMMON. SPECIES WAS INTRODUCED *01*.
SPARROW, LARK	OCCURS IN GRASSLAND, OLD FIELDS, EDGE AND RESIDENTIAL AREAS.	SUMMER RESIDENT, UNCOMMON *01*
SPARROW, LINCOLN'S	OCCUR IN SHRUBLAND, ROADSIDES, HEDGEROWS, EDGE, THICKETS AND OLD FIELDS. PREFER AREAS WITH GRASSES AND SEDGES INTERSPERSED WITH SHRUBS 4-8 FEET TALL.	UNCOMMON TRANSIENT, RARE WINTER RESIDENT *01*
SPARROW, SONG	INHABIT SHRUBBY SHORES OF PONDS AND STREAMS, ROADSIDES, FENCEROWS, SHRUBBY WET MEADOWS AND CATTAIL SWAMPS. PREFER MOIST GROUND WITH LOW, DENSE IRREGULAR PLANT GROWTH.	COMMON SUMMER RES. IN EXTREME EAST MO, UNCOMMON SUMMER RES. IN NORTH MO, CASUAL SUMMER RES. ELSEWHERE *01*
STARLING, EUROPEAN	PREFERS MIXED HABITATS CLOSE TO PASTURES AND CROPLAND. PREFER NEST TREES 6-30 IN. DBH. OFTEN FOUND IN RESIDENTIAL AREAS.	COMMON PERMANENT RESIDENT. *02*
SWALLOW, BANK	OCCUR NEAR GRASSLAND OR CROPLAND, PREFERABLY NEAR WATER. REQUIRE ABRUPT BANK WITH MINIMAL VEGETATION FOR NESTING.	UNCOMMON SUMMER RESIDENT - NORTH. *02*

1 OCCUR IN ST. FRANCOIS COUNTY

	GENERAL HABITAT	COMMENTS ON OCCURRENCE IN MISSOURI
SWALLOW, BARN	FORAGE OVER GRASSLAND, MARSHES, CROPLAND OR WATER, USUALLY WITHIN .5 MILES OF NEST SITE. PREFER MAN-MADE STRUCTURES FOR NEST SITES, ESPECIALLY BUILDINGS.	SUMMER RESIDENT, COMMON *01*
SWALLOW, CLIFF	FORAGE OVER GRASSLAND, CROPLAND,	UNCOMMON SUMMER RESIDENT. *02*. 58

	MARSHES AND WATER. REQUIRE VERTICAL SUBSTRATE WITH AN OVERHANG FOR NEST ATTACHMENT, SUCH AS CLIFFS, DAMS, BRIDGES OR BUILDINGS. FORAGE OVER MARSHES AND WATER. USE CLIFFS, LEDGES, ROADCUTS AND BRIDGES FOR NEST SITES. FORAGE OVER MEADOWS, PONDS, RIVERS, MARSHES OR SWAMPS. NEST IN TREE CAVITIES, OFTEN OVER WATER. USUALLY NEST IN CHIMNEYS. OCCASIONALLY USE SILOS OR CAVITY TREES > 8 INCHES DBH. INHABIT LARGE DECIDUOUS FORESTS (>100 HA). PREFER AREAS WITH SHORT GROUND VEGETATION. PREFER NEST TREES AT LEAST 9 IN. DBH. PREFER LARGE DECIDUOUS FORESTS WITH CANOPY HEIGHT 12-20 M. AND SPARSE GROUND COVER.	COLONIES IN STATE - LARGEST KNOWN COLONY HAS 350 NESTS. *03*
SWALLOW, NORTHERN ROUGH-WINGED		SUMMER RESIDENT, COMMON *01*
SWALLOW, TREE		COMMON TRANSIENT, RARE SUMMER RESIDENT. *02*
SWIFT, CHIMNEY		COMMON SUMMER RESIDENT *01*
TANAGER, SCARLET		COMMON SUMMER RESIDENT IN SOUTH, UNCOMMON IN NORTH *02*
TANAGER, SUMMER		SUMMER RESIDENT
- 10 OCCUR IN ST. FRANCOIS COUNTY		
	GENERAL HABITAT	COMMENTS ON OCCURREN IN MISSOURI
----- TEAL, BLUE-WINGED	----- INHABIT MARSHES, SLOUGHS, STREAMS, PONDS, LAKES AND RESERVOIRS WITH EMERGENT VEGETATION AND SHALLOW WATER. NEST NEAR WATER IN SEDGE, SLOUGHGRASS, BLUEGRASS OR OTHER DENSE GRASS.	----- WIDELY DISTRIB. IN EARLY FALL AND LATE SPRING. OCCASSIONAL BREEDER *45*
TEAL, GREEN-WINGED	OCCURS IN MARSHES, SWAMPS, PONDS, LAKES, RESERVOIRS, STREAMS AND FLOODED BOTTOMLAND. PREFERENCES MODERATELY DENSE AQUATIC VEGETATION INTERSPERSED THROUGHOUT THE WATER.	TRANSIENT COMMON, WINTER RESIDENT UNCOMMON, SUMMER VISITANT, A NON-BREEDER *01*
TERN, CASPIAN	OCCURS IN MARSHES, STREAMS, PONDS,	TRANSIENT, UNCOMMON, SUMMER VISITANT,

THRASHER, BROWN	<p>LAKES AND RESERVOIRS. OCCURS IN BRUSHY, LOW, DENSE VEGETATION ALONG EDGES AND HEDGEROWS. PREFER DENSE VEGETATION FROM 0-20 FEET AND A LOW CANOPY.</p> <p>THRUSH, WOOD</p> <p>OCCUR IN LARGE STANDS OF MATURE LOWLAND HARDWOODS WITH CANOPY CLOSURE > 70%, SUBCANOPY > 60%, ABUNDANT UNDERGROWTH AND A TALL CANOPY.</p> <p>TITMOUSE, TUFTED</p> <p>OCCUR IN THICKETS, ORCHARDS, WOODLAND AND RESIDENTIAL AREAS.</p> <p>NEST IN CAVITY TREES 4-30 IN. DBH. PREFER AREAS WITH >75% CANOPY CLOSURE AND CANOPY HEIGHT OF 12-24 M.</p> <p>10 OCCUR IN ST. FRANCOIS COUNTY</p>	<p>CASUAL *01*</p> <p>COMMON SUMMER RESIDENT, UNCOMMON WINTER RES. IN S.E. MO</p> <p>*01*</p> <p>COMMON SUMMER RESIDENT-STATEWIDE</p> <p>*02, 05*</p> <p>COMMON PERMANENT RESIDENT-STATEWIDE.*</p> <p>02*</p>
GENERAL HABITAT		
TOWHEE, RUFOUS-SIDED	<p>INHABIT OLD FIELDS, EDGE AND WOODLAND WITH 70-90% LITTER COVERAGE .01-.03 M DEEP, AND >60% GROUND VEGETATION.</p> <p>TURKEY, WILD</p> <p>OCCUR IN MATURE FORESTS WITH OPENINGS, CLEARINGS AND SMALL AGRICULTURAL FIELDS. ALSO USE CROPLAND AND GRASSLAND INTERSPERSED WITH SMALL WOODED TRACTS.</p> <p>VIREO, RED-EYED</p> <p>OCCUR IN LARGE UPLAND AND BOTTOMLAND DECIDUOUS FORESTS WITH 65-90% CANOPY CLOSURE, SHORT GROUND VEGETATION AND CANOPY HEIGHT > 12 M.</p> <p>VIREO, WARBLING</p> <p>OCCUR IN OPEN MIXED OR DECIDUOUS MATURE FOREST WITH 40-85% CROWN CLOSURE, 30-80% SUBCANOPY, 30-65% GROUND VEGETATION AND CANOPY HEIGHT > 16 M.</p> <p>VIREO, WHITE-EYED</p> <p>INHABIT SHRUBBY,</p>	<p>COMMENTS ON OCCURREN IN MISSOURI</p> <p>COMMON SUMMER RESIDENT STATEWIDE, RARE WINTER RESIDENT - SOUTH.*02*</p> <p>STATEWIDE</p> <p>SUMMER RESIDENT, COMMON</p> <p>SUMMER RESIDENT , CASUAL *01*</p> <p>SUMMER RESIDENT,</p>

VIREO,
YELLOW-THROATED

BRUSHY UNDERGROWTH
IN OLD FIELDS, ALONG
FOREST EDGE AND IN
OPEN FORESTS. PREFER
DENSE FOLIAGE .3-1 M
ABOVE GROUND BUT
SPARSE HERBACEOUS
GROUND VEGETATION.
OCCUR IN MATURE
HARDWOOD FORESTS
WITH 70-90% CANOPY
CLOSURE,
50-90% SUBCANOPY AND
CANOPY HEIGHT > 12
M. PREFER DENSE
FOLIAGE FROM .3-1 M
ABOVE GROUND.

UNUSUAL *01*

SUMMER RESIDENT ,
UNCOMMON

1OCCUR IN ST. FRANCOIS COUNTY

GENERAL HABITAT

VULTURE, TURKEY

OCCURS IN WOODED AND
SEMI-OPEN COUNTRY.
PREFERS AT LEAST
1 SNAG PER ACRE.
PREFERRED DBH OF
NEST TREES > 20
INCHES.

COMMENTS ON OCCURREN
IN MISSOURI

COMMON SUMMER
RESIDENT-STATEWIDE,
RARE WINTER
RESIDENT-SE
02,03

WARBLER, BLUE-WINGED

INHABITS BRUSHY OLD
FIELDS, FOREST EDGE,
FENCEROWS, AND
SECOND-GROWTH FOREST
WITH BRUSHY
OPENINGS. PREFER
CANOPY

UNCOMMON SUMMER
RESIDENT *01*

WARBLER, CERULEAN

CLOSURE 38%, 83%
SHALLOW LITTER
COVER, 98%
HERBACEOUS COVER
AVG. .53 M TALL.
OCCURS IN LARGE
DECIDUOUS FORESTS
WITH LITTLE
UNDERGROWTH.
BUT GOOD HERBACEOUS
GROUND COVER.

SUMMER RESIDENT,
UNCOMMON (SOUTH),
RARE (NORTH) *01*

WARBLER, HOODED

INHABIT LARGE
LOWLAND FORESTS WITH
A TALL CANOPY, GOOD
HERBACEOUS GROUND
COVER AND DENSE
BRUSHY FOLIAGE
FROM .3-1
M ABOVE GROUND.
PREFERS SWAMPY
AREAS.

SUMMER RESIDENT,
RARE (SOUTH), CASUAL
(NORTH) *01*.

WARBLER, KENTUCKY

INHABITS LARGE
CONTIGUOUS TRACTS OF
WOODLAND (500-1000
AC FOR
OPTIMUM HABITAT
QUALITY). PREFERS
LARGE POLE TO MATURE
FORESTS
WITH DENSE
VEGETATION AT ALL
LAYERS.

UNCOMMON SUMMER
RESIDENT -
STATEWIDE.*02*

10CCUR IN ST. FRANCOIS COUNTY

	GENERAL HABITAT	COMMENTS ON OCCURREN IN MISSOURI
WARBLER, PRAIRIE	INHABIT OLD FIELDS, FOREST EDGE AND BRUSHY HILLSIDES. PREFER 40-75% CANOPY CLOSURE, < 10% BARE GROUND, SHALLOW LITTER. PREFER TREES > 13 M WITHIN TERRITORY AND NEST TREES 2-5 CM DBH.	UNCOMMON SUMMER RESIDENT *01*
WARBLER, PROTHONOTARY	INHABITS MATURE FOREST STANDS IN BOTTOMLAND FORESTS ADJACENT TO WATER. FOREST TRACTS >250 ACRES PREFERRED. SNAGS AND SECONDARY CAVITIES ARE IMPORTANT FOR NESTING.	UNCOMMON SUMMER RESIDENT *02,03*
WARBLER, WORM-EATING	INHABIT LARGE UPLAND HARDWOOD FORESTS WITH TALL CANOPY, DENSE FOLIAGE FROM .3-1 M, AND UNDERSTORY OF SAPLINGS AND SMALL SHRUBS.	SUMMER RESIDENT, UNCOMMON (SOUTH), RARE (NORTH) *01*. A BREEDER *06*.
WARBLER, YELLOW	INHABITS SWAMPS, MARSHES, AND WOODED AREAS ALONG STREAMS, PONDS, LAKES AND RESERVOIRS.	TRANSIENT, COMMON, SUMMER RESIDENT, UNCOMMON *01*
WARBLER, YELLOW-THROATED	OCCURS IN MIXED WOODLAND, BOTTOMLAND HARDWOODS, AND CYPRESS SWAMPS. PREFER TALL TREES.	SUMMER RESIDENT, UNCOMMON, CASUAL (NORTHWEST) *01* SUMMER RESIDENT IN SOUTHERN THIRD OF THE STATE, CASUAL ELSEWHERE, A BREEDER *06*.
WATERTHRUSH, LOUISIANA	OCCUR IN SWAMPS AND LARGE RIPARIAN FORESTS WITH DENSE SHRUBBY VEGETATION ADJACENT TO FLOWING WATER.	SUMMER RESIDENT, UNCOMMON (SOUTH), RARE (NORTH) *01*

10CCUR IN ST. FRANCOIS COUNTY

	GENERAL HABITAT	COMMENTS ON OCCURREN IN MISSOURI
WAXWING, CEDAR	INHABITS OPEN WOODLANDS WITH SCATTERED DENSE CONIFER THICKE PREFERS AREAS NEAR WATER WITH GOOD	COMMON WINTER RESIDENT, RARE SUMMER RESIDENT *01*

WHIP-POOR-WILL	HERBACEOUS GROUND COVER. INHABIT YOUNG STANDS IN OPEN DECIDUOUS OR MIXED WOODLANDS WITH GOOD LITTER COVER.	COMMON SUMMER RESIDENT *01*
WIGEON, AMERICAN	OCCUR IN FLOODED BOTTOMLANDS, MARSHES, SWAMPS, SLOUGHS, PONDS, LAKES AND RESERVOIRS. WITH EMERGENT AQUATIC VEGETATION.	TRANSIENT, COMMON, WINTER RESIDENT, UNCOMMON, UNUSUAL SUMMER RESIDENT. *01,20*
WOODCOCK, AMERICAN	HABITAT PREFERENCE IS RELATED TO SOIL CONDITIONS AND PLANT STRUCTURE RATHER THAN PLANT SPECIES COMPOSITION. IS DEPENDENT ON MOIST SOIL FOR YEAR ROUND FEEDING. OCCURS IN A MIXTURE OF SEMI-OPEN HABITATS ON POORLY DRAINED SITES.	RARE SUMMER RESIDENT, UNCOMMON TRANSIENT-EAST, RARE-WEST, CASUAL WINTER RESIDENT.*02*
WOODPECKER, DOWNY	OCCURS IN DECIDUOUS OR MIXED FOREST AND FOREST EDGE WITH SNAGS AND CAVITY TREES. PREFER CANOPY HEIGHT 12-20 M. SUBCANOPY 65-90%, LITTLE HERBACEOUS GROUND COVER AND CAVITY TREES 6-12 INCHES DBH.	COMMON PERMANENT RESIDENT *03*
OCCUR IN ST. FRANCOIS COUNTY		
	GENERAL HABITAT	COMMENTS ON OCCURREN IN MISSOURI
WOODPECKER, HAIRY	INHABITS FORESTS AND SWAMPS WITH SNAGS AND CAVITY TREES. PREFER SUBCANOPY 50-75%, 40-65% GROUND VEGETATION AND NEST TREES 8-18 INCHES DBH.	UNCOMMON PERMANENT RESIDENT *03*
WOODPECKER, PILEATED	PREFERS BOTTOMLAND AND UPLAND MATURE TO OLD GROWTH FOREST WITH LARGE TREES AND SNAGS (> 14 IN. DBH), CAVITIES AND CONTIGUOUS FOREST CANOPY.	UNCOMMON PERMANENT RESIDENT - SOUTHERN HALF OF MO. *42*
WOODPECKER, RED-BELLIED	OCCUR IN FORESTS AND FOREST EDGE WITH SNAGS AND CAVITY TREES. PREFER NEST	COMMON PERMANENT RESIDENT *03*

WOODPECKER, RED-HEADED	TREES 60-200 YEARS OLD AND 12-24 INCHES DBH. INHABIT OPEN WOODLAND, WOODLAND EDGE, SWAMPS AND SLOUGHS WITH SNAGS. PREFER SUBCANOPY >55% AND GROUND VEGETATION > 45%. PREFER NEST TREE DBH 15-24 INCHES.	COMMON PERMANENT RESIDENT *03*
WREN, BEWICK'S	INHABIT THICK BRUSY VEGETATION AT FOREST EDGE.	MOSTLY SOUTHERN DISTRIBUTION, LESS LIKELY IN NORTHERN AREAS *18*
WREN, CAROLINA	OCCUR IN BRUSHY TANGLES AND LOG PILES IN RIPARIAN HABITAT. PREFER AREAS WITH SNAGS AND GOOD CANOPY COVER.	STATEWIDE DISTRIBUTION FOLLOWING MILD WINTER CONDITIONS *25*
WREN, HOUSE	OCCUR IN OLD FIELDS AND FOREST EDGE WITH DENSE GROUND VEGETATION AND SNAGS.	STATEWIDE DISTRIBUTION *22*
WREN, MARSH	INHABIT MARSHES WITH DENSE EMERGENT VEGETATION, ESPECIALLY CATTAILS.	STATEWIDE DISTRIBUTION DURING MIGRATION PERIODS.
10 OCCUR IN ST. FRANCOIS COUNTY		
	GENERAL HABITAT	COMMENTS ON OCCURREN IN MISSOURI
----- WREN, SEDGE	----- INHABIT MARSHES OR SEdge AND GRASS MEADOWS.	----- STATEWIDE DURING MIGRATION PERIODS *17*
YELLOWTHROAT, COMMON	INHABITS MARSHES, SWAMPS, BOTTOMLAND FORESTS AND OLD FIELDS WITH DENSE LOW COVER AND BRUSHY THICKETS. PREFER OPEN CANOPY AND GROUND VEGETATION > 85%. NEST SHRUBS AVERAGE 1.2 M.	COMMON SUMMER RESIDENT - STATEWIDE *02*
BEAVER	OCCUR IN AQUATIC HABITATS WITH PERMANENT WATER. MUST HAVE ADEQUATE SUPPLY OF WOODY AND HERBACEOUS FOOD. COTTONWOOD FORESTS ARE PREFERRED BUT NOT NECESSARY. STABLE STREAMBANKS ARE IMPORTANT.	PRIOR TO CIVIL W.-COMMON EVERY MAJOR WATERSHED. 1895-ONLY FEW COLON. REMAINED NW MO. 1939-1955 RESTOCKING PROGRAM- RESULTED IN REESTABLISHMENT THROUGHOUT MO. *06*
BOBCAT	IN THE OZARKS, PREFER HEAVILY FORESTED AREAS INTERSPERSED WITH 2ND-GROWTH TIMBER, REGENERATION CUTS AND OPENINGS. IN	

CHIPMUNK, EASTERN

PRAIRIE
REGION, USE WOODED
OR BRUSHY CREEKS AND
DITCHES. THICKETS,
BLUFFS AND HOLLOW
TREES PROVIDE
RESTING SITES.
INHABIT TIMBER EDGE
AND ROCKY RIDGES
WITH LOGS, STUMPS,
ROCKS, BRUSHPILES,
ETC. PREFER SPARSE
FORB COVER AND GOOD
SHRUB AND EVERGREEN
COVER.

MOST COMMON IN OZARK
HIGHLAND *01*

10CCUR IN ST. FRANCOIS COUNTY

COYOTE

GENERAL HABITAT

PREFER BRUSHY,
SEMI-OPEN COUNTRY
SUCH AS FARMLAND OR
EDGE.
DENS USUALLY LOCATED
NEAR WATER,
TYPICALLY IN
BLUEGRASS,
FESCUE, BLACKBERRY,
MULTIFLORA ROSE,
LOCUST, SASSAFRAS.
OPTIMUM HABITAT IS
FOREST LAND WITH
DIVERSE SIZE AND AGE
CLASSES,
INTERSPERSED WITH
CROP FIELDS,
GRASSLAND, AND
EDGES.

COMMENTS ON OCCURREN
IN MISSOURI

STATEWIDE, BUT MOST
ABUNDANT IN PRAIRIE
REGIONS OF
NORTHERN & WESTERN
MO *01*

DEER, WHITE-TAILED

PREFER FORESTS
INTERSPERSED WITH
FIELDS OR BRUSHY
FENCEROWS.
DENS OFTEN MADE IN
HOLLOW LOGS OR
ROTTEN STUMPS, AND
ARE
USUALLY NEAR
PERMANENT WATER.
OCCUR IN PATCHY
HABITAT SUCH AS
FOREST EDGE, OLD
FIELDS, OR
CROPLAND, USUALLY
NEAR PERMANENT
WATER.

STATEWIDE *01* EST.
POP. IN 1925 WAS 395
DEER. FROM 1925-
1930, 271 DEER FROM
MI AND 91 DEER FROM
PRIVATE OWNERS IN
MO WERE STOCKED.*01*
CURRENT POP. EST.
400,000 *02*
MOST COMMON IN OZARK
HIGHLAND. IN NW MO,
FOUND IN FORESTED
LOESS HILLS.*02*

FOX, GRAY

FOX, RED

MINK

OCCUR ALONG BANKS OR
STREAMS, RIVERS,
PONDS, LAKES OR
MARSHES.
PERMANENT WATER IS
REQUIRED. TIMBERED
HABITAT IS
PREFERRED.
STUMPS AND HOLLOW
LOGS ENHANCE

MOST COMMON N. OF
MO. RIVER, LEAST
ABUND.-MISS.
LOWLAND.

MOLE, EASTERN

HABITAT.
OCCUR IN PASTURES,
OPEN WOODLANDS,
STREAMBANKS AND
LAWNS.
NEED MOIST,
WELL-DRAINED LOOSE
SOIL WITH HUMUS.

STATEWIDE *01*

1OCCUR IN ST. FRANCOIS COUNTY

GENERAL HABITAT

COMMENTS ON OCCURREN
IN MISSOURI

MOUSE, DEER

OCCUR IN OPEN
HABITAT INCLUDING
PASTURE, CROP
FIELDS, EDGE,
FENCEROWS AND
ROADSIDES. PREFER
FORB COVER TO GRASS
COVER.

OCCURS STATEWIDE
01

MOUSE, GOLDEN

INHABIT FOREST
OPENINGS > .8 HA.
INHABIT DECIDUOUS
FORESTS WITH DENSE
UNDERSTORY AND
TANGLES
OF VINES, MANY
FALLEN LOGS. GOOD
LITTER COVER AND
MANY

OCCURS IN THE OZARKS
& IN SOUTHEAST MO
03

MOUSE, HOUSE

HERBACEOUS STEMS.
GENERALLY LIVE IN
CLOSE ASSOCIATION
WITH MAN. OCCUR IN
GRAIN

THROUGHOUT MO. *02*

MOUSE, WHITE-FOOTED

FIELDS, GRAIN
STORAGE FACILITIES,
FENCEROWS, DITCHES,
AND
OCCASIONALLY IN
GRASSLAND OR
WOODLAND.
INHABIT FORESTS,
BRUSHY AREAS,
FENCEROWS, AND
GRASSLAND OR
CROPLAND WITH WOODY
OR BRUSHY BORDERS.
STUMPS, LOGS,
LITTER,

OCCURS STATEWIDE
01

MUSKRAT

SNAGS, BRUSHPILES
AND DENSE SHRUBS
ENHANCE HABITAT.
OCCUR IN AQUATIC
HABITATS WITH STILL
OR SLOW-MOVING WATER
INTERSPERSED
WITH EMERGENT AND
SUBMERGENT
VEGETATION. STABLE
WATER LEVELS ARE
IMPORTANT. CATTAILS
ARE PREFERRED
VEGETATION IN
MARSHES.

OCCURS STATEWIDE
01

1OCCUR IN ST. FRANCOIS COUNTY

GENERAL HABITAT

COMMENTS ON OCCURREN

IN MISSOURI

STATEWIDE *01*
LARGEST POPULATIONS
OCCUR IN THE WESTERN
PRAIRIE & OZARK
BORDER REGIONS *15*

OCCURS STATEWIDE
01

STATEWIDE, LESS
COMMON IN OZARK
HIGHLAND AREA *02*

STATEWIDE *02*

STATEWIDE *01*

COMMENTS ON OCCURREN
IN MISSOURI

STATEWIDE

STATEWIDE *03,02,01*

OPOSSUM, VIRGINIA

PREFER MIXED AGE
CLASS WOODLANDS
ALONG SMALL STREAMS.
ALSO
OCCUR IN OLD FIELDS,
PASTURE AND
FENCEROWS AND EDGE.
USE
LOGS, STUMPS AND
SNAGS (>12 IN. DBH)
AS DENS.

RABBIT, EASTERN
COTTONTAIL

OCCUR IN OPEN LAND,
SEMI-OPEN LAND AND
FOREST EDGE
HABITATS.
MUST HAVE DENSE
WOODY VEGETATION OR
BRUSH PILES FOR
ESCAPE AND
WINTER COVER. PREFER
80% HERBACEOUS
GROUND COVER.

RACCOON

PREFER HARDWOOD
FORESTS ADJACENT TO
WATER, BUT ALSO
OCCUR IN
UPLAND, BOTTOMLAND
AND PINE-HARDWOOD
FORESTS. CAVITY
TREES

RAT, NORWAY

ARE IMPORTANT (>14
IN. DBH PREFERRED).
OCCUR NEAR HUMAN
HABITATION. FEED IN
GRAIN FIELDS OR
STORAGE

SKUNK, STRIPED

AREAS, PASTURES AND
WATER AREAS.
INHABIT HAYFIELDS,
PASTURE, CROPLANDS,
FENCEROWS AND FOREST
BORDERS NEAR
PERMANENT WATER.
BRUSHPILES, ROCK
PILES AND
CAVES ENHANCE
HABITAT.

1OCCUR IN ST. FRANCOIS COUNTY

GENERAL HABITAT

SQUIRREL, FOX

OCCUR IN HARDWOOD,
PINE AND MIXED
PINE-HARDWOOD
FORESTS WITH
PREFER NEST TREES
APPROX. 20 FT. TALL
AND 40-46 CM DBH.
PRESENCE OF DENSE
WOODY STEMS > 1M
TALL AND < 2.5 CM
DBH IS
BENEFICIAL.

SQUIRREL, GRAY

OCCUR IN HARDWOOD,

SQUIRREL, SOUTHERN
FLYING

PINE AND MIXED
PINE-HARDWOOD
FORESTS WITH
MODERATELY OPEN
UNDERSTORY AND DENSE
SHRUB CROWN.
PRESENCE OF
SNAGS (9-36 IN. DBH)
IS PREFERRED.

OCCURS STATEWIDE
03,08

VOLE, PRAIRIE

OCCUR IN DECIDUOUS
MATURE OR OLD GROWTH
FOREST WITH
OPENINGS,
CAVITIES, AND SNAGS
(9-36 IN. DBH).
PROXIMITY TO WATER
PREFERRED.
INHABIT GRASSLAND,
OLD FIELDS,
THICKETS, FENCEROWS,
EDGE, CROP
FIELDS AND
ROADSIDES. PREFER
LITTER DEPTH 4-12
CM, >70% HERB.
GROUND COVER AND
GRASS HEIGHT 40 CM.

OCCURS STATEWIDE
01

IRARE-ENDANGERED IN ST. FRANCOIS COUNTY

	STATUS
SALAMANDER, FOUR-TOED	NONGAME
TURTLE, ALLIGATOR SNAPPING	STATE RARE
EGRET, GREAT	STATE RARE
HAWK, COOPER'S	FEDERAL CANDIDATE
	NONGAME
	STATE RARE
	STATE RARE
	SENSITIVE
HARRIER, NORTHERN	NONGAME
	STATE ENDANGERED
HAWK, SHARP-SHINNED	NONGAME
	STATE RARE
HERON, LITTLE BLUE	NONGAME
	NONGAME
KITE, MISSISSIPPI	STATE RARE
	NONGAME
SPARROW, HENSLOW'S	STATE RARE
	NONGAME
	STATE RARE

ILIKELY TO OCCUR IN ST. FRANCOIS COUNTY:

GENERAL HABITAT

COMMENTS ON OCCURREN

IN MISSOURI

WIDESPREAD IN MO,
ABUNDANT IN MS. R. &
ITS MAJOR TRIBUTAR.
IN NE MO,
OCCURS-LOWLAND
STREAMS & DITCHES OF
THE SE & INLARGE
OZARK
RESERVOIRS.*01*
ONE OF MOST
WIDESPREAD &
ABUNDANT LARGE
FISHES IN MO.*01*

NEARLY STATEWIDE,
BUT RARE OR ABSENT
FROM MANY STREAMS OF
CENTRAL OZARKS & NW
PART OF PRAIRIE
REGION.*01*

OCCUR IN A BROAD
BAND FROM SPRING
RIVER, NE INTO UPPER
MISS. RIVER AND ITS
TRIBS., ALSO AT
SCATTERED LOCALITIES
SOUTHWARD ALONG
MISS. RIVER *01*
OCCURS STATEWIDE,
MOST ABUNDANT IN MO
& MISS. R. &
DOWNSTREAM SECTIONS
OF THEIR LARGER
TRIBUTARIES *16*

IS THE MOST WIDELY
DISTRIBUTED GAR IN
MO, PROBABLY OCCURS
IN EVERY MAJOR
STREAM IN THE STATE.
MOST ABUNDANT IN THE
LARGE RESERVOIRS OF
THE OZARKS *01*
OCCURS IN LARGE
STREAMS & RES. OF
CENTRAL & SOUTHERN
OZARKS, & IN MISS.
R. *01*

COMMENTS ON OCCURREN IN MISSOURI

COMMON IN SE MO
LOWLANDS, ALSO
OCCURS IN SOME
STREAMS OF
SOUTHERN & EASTERN
OZARKS *01*

BUFFALO, SMALLMOUTH

OCCURS IN STREAMS,
BACKWATERS, OXBOWS,
IMPOUNDMENTS
AND SWAMPS. PREFERS
CLEAR WATER AND
AVOIDS STRONG
CURRENTS.

CARP, COMMON

ARE MOST ABUNDANT IN
LARGE STREAMS, LAKES
AND
RESERVOIRS. PREFER
LITTLE OR NO CURRENT
AND SHALLOW
WATER. TOLERATE WIDE
RANGE OF TURBIDITY.

CRAPPIE, WHITE

OCCURS PRIMARILY IN
STREAMS, LAKES AND
RESERVOIRS. PREFER
AREAS

DARTER, SLENDERHEAD

WITH COVER SUCH AS
STANDING TIMBER,
SUBMERGED BRUSH OR
AQUATIC VEGETATION.
INHABITS SHALLOW
RIFFLES IN STREAMS
WITH MODERATE
TO SWIFT CURRENT AND
SAND OR GRAVEL
BOTTOMS.

DRUM, FRESHWATER

OCCURS IN LARGE
STREAMS, RIVERS AND
RESERVOIRS.

GAR, LONGNOSE

TOLERATES
HIGH TURBIDITY BUT
AVOIDS STRONG
CURRENT. PREFERS
SAND,
MUD OR SILT BOTTOM.
USUALLY FOUND IN
POOLS, BACKWATERS
AND OXBOWS OF LARGE,
MODERATELY CLEAR
STREAMS. PREFERS
QUIET WATER.

MOONEYE

OCCURS IN RESERVOIRS
AND CLEAR, QUIET
POOLS OF STREAMS
AND DITCHES.

ILIKELY TO OCCUR IN ST. FRANCOIS COUNTY:

GENERAL HABITAT

PICKEREL, GRASS

OCCURS IN LAKES,
SLOUGHS, OXBOWS,
DITCHES, BORROW
PITS,
SWAMPS, MARSHES,
BACKWATERS AND
STREAMS WITH LITTLE
OR
NO CURRENT, DENSE

REDHORSE, RIVER	VEGETATION AND CLEAR WATER. INHABITS POOLS OF CLEAR PERMANENT STREAMS AND DITCHES WITH MODERATE TO SWIFT CURRENT AND GRAVEL BOTTOMS.	OCCURS THROUGHOUT OZARKS, BUT NOT ABUNDANT AT ANY LOCATION *01*
REDHORSE, SILVER	INHABITS POOLS OF MODERATELY CLEAR PERMANENT STREAMS WITH GRAVEL OR RUBBLE BOTTOMS, LOW GRADIENT AND SLOW CURRENT.	SEEMS MOST ABUNDANT IN SALT RIVER SYSTEM, WIDESPREAD, BUT SELDOM ABUNDANT IN N. & E. OZARKS. *01*
SCULPIN, BANDED	OCCURS IN POOLS AND RIFFLES OF SPRING BRANCHES AND STREAMS WITH GRAVEL-COBBLE-BOULDER BOTTOMS.	OCCUR IN MOST OF THE PRINCIPAL STREAM SYSTEMS OF THE OZARKS AND IN CUIVRE RIVER DRAINAGE NORTH OF MO RIVER *01*
SCULPIN, MOTTLED	OCCURS IN RIFFLES AND POOLS OF SPRING BRANCHES AND COOL STREAMS. MOST ABUNDANT NEAR COVER SUCH AS COARSE ROCK OR THICK GROWTHS OF WATERCRESS.	OCCUR IN MOST OF PRINCIPAL OZARK STREAM SYSTEMS *01*
SHAD, GIZZARD	INHABITS QUIET WATERS OF LAKES, PONDS, RESERVOIRS, BACKWATERS AND POOLS OF PERMANENT STREAMS. TOLERATES WIDE RANGE OF TURBIDITY. PREFERS WATERS WITH HIGH FERTILITY AND PRODUCTIVITY.	OCCURS AT LEAST OCCAS. IN EVERY MAJOR STREAM SYSTEM. IS MOST ABUNDANT IN RESERVOIRS & LARGE RIVERS. *01*
SHINER, TELESCOPE	OCCURS NEAR RIFFLES IN PERMANENT STREAMS WITH GRAVEL BOTTOMS.	ABUNDANT & WIDESPREAD IN SOUTHERN OZARKS *01*

ILIKELY TO OCCUR IN ST. FRANCOIS COUNTY:

	GENERAL HABITAT	COMMENTS ON OCCURREN IN MISSOURI
STONECAT	USUALLY FOUND IN SWIFT CURRENT ON ROCKY RIFFLES IN PERMANENT STREAMS.	IS THE MOST ABUNDANT MADTOM IN MOST LARGE STREAMS OF THE OZARKS & THE PRAIRIE REGION. ALSO OCCURS COMMONLY IN THE UPPER MISS. R., RARE IN LOWER MISS. & MO R. *01*
SUCKER, SPOTTED	OCCURS IN SLOUGHS, SWAMPS, DITCHES, OXBOWS, PONDS, BACKWATERS AND POOLS OF STREAMS. PREFERS CLEAR, QUIET WATER WITH ABUNDANT AQUATIC VEGETATION AND SOFT BOTTOMS WITH ORGANIC DEBRIS.	COMMON & GENERALLY DISTRIBUTED IN LOWLANDS OF SE MO, OCCURS AT SCATTERED LOCALITIES NORTHWARD IN OZARKS & IN NE PRAIRIE REGION. *01*

TREEFROG, COPE'S
GRAY

OCCURS IN WOODLAND
AND WOODLAND EDGE.
BREED IN WOODLAND
POOLS WITH WEEDY
VEGETATION.

LIKELY TO OCCUR
STATEWIDE. *02*

TREEFROG, GRAY

INHABITS DAMP
HARDWOOD FORESTS
SURROUNDING SWAMPS
AND
SMALL PONDS.

LIKELY TO OCCUR
STATEWIDE. *02*

FROG, PICKEREL

OCCURS IN WET CAVES,
SWAMPS, MARSHES,
SLOUGHS, DITCHES,
SPRINGS AND STREAMS
BORDERED BY WEEDY OR
GRASSY VEGETATION.

OCCUR S. HALF OF MO.
AND ALONG MISS.
RIVER IN E. AND NE.
PARTS OF STATE *01*

FROG, UPLAND CHORUS

INHABITS UPLAND AND
FLOODPLAIN FORESTS.
LAY EGGS ON
SUBMERGED VEGETATION
IN TEMPORARY PONDS,
SWAMPS OR
MARSHES.

INTERGRADES W/, &
REPLACES WESTERN
CHORUS FROG IN SE
CORNER OF MO. *02*

FROG, WESTERN CHORUS

ARE MOST ABUNDANT IN
GRASSLAND, BUT ALSO
OCCUR IN DAMP
WOODLAND OR IN
CROPLAND. BREED IN
PONDS, LAKES, PONDS,
MARSHES OR FLOODED
CROP FIELDS.

STATEWIDE, EXCEPT SE
CORNER WHERE IS
REPLACED BY UPLAND
CHORUS FROG. *02*

ILIKELY TO OCCUR IN ST. FRANCOIS COUNTY:

GENERAL HABITAT

FROG, WOOD

OCCUR IN MARSHES,
WOODLAND PONDS OR
INTERMITTENT STREAMS
IN FORESTS WITH LEAF
LITTER.

COMMENTS ON OCCURREN
IN MISSOURI

SPECIES HAS A
SCATTERED,
QUESTIONABLE
DISTRIBUTION *01*

PEEPER, NORTHERN
SPRING

INHABIT SWAMPS OR
FORESTS NEAR POND OR
STREAMS WITH THICK
UNDERGROWTH. PREFER
BREEDING SITES WITH
TREES OR SHRUBS
STANDING IN WATER.

THROUGHOUT MO,
EXCEPT EXTREME NW
CORNER. *02*

SALAMANDER, TIGER

OCCUR IN WOODLANDS,
SWAMPS, PRAIRIES AND
NEAR FARM PONDS.
BREED IN FISHLESS
PONDS OR MARSHES.

APPEARS THAT THE
SALAMANDER IS
UNCOMMON IN THE
OZARKS.

SALAMANDER, MARBLED

PREFERS FORESTED
AREAS WITH ROCKS,
LOGS AND LEAF
LITTER.

THROUGHOUT MO,
EXCEPT FOR OZARKIAN
PLATEAU & EXTREME NW
CORNER OF STATE. *01*

SALAMANDER,
SMALLMOUTH

BREEDS IN WOODLAND
PONDS OR SWAMPS.
OCCUR IN WOODLAND,
PRAIRIE, FLOODPLAIN,
SWAMPS AND CROPLAND.
BREED IN PONDS,
STREAMS, SLOUGHS AND
DITCHES.

SIREN, WESTERN
LESSER

OCCURS IN SWAMPS,
SLOUGHS, DITCHES,
PONDS AND STREAMS
WITH

OCCURS EXTREME
EASTERN PORTION OF
OZARK PLATEAU & IN
MISSISSIPPI RIVER

TOAD, EASTERN
NARROWMOUTH

SPADEFoot, EASTERN

SHALLOW WATER,
LITTLE OR NO
CURRENT, AND DENSE
AQUATIC
VEGETATION.
OCCUR IN WOODLAND,
GRASSLAND, OLD
FIELDS OR SWAMPS
NEAR PONDS
OR STREAMS. BREED IN
WATER WITH AQUATIC
VEGETATION.
OCCUR IN OLD FIELDS
AND ALONG WOODLAND
EDGE. BREED IN
POOLS WITH
SUBMERGENT
VEGETATION.

LOWLANDS. *02*

OCCURS IN SOUTHERN
HALF OF STATE *01*

HAS BEEN COLLECTED
FROM SOUTHEAST
CORNER OF THE STATE
01

ILIKELY TO OCCUR IN ST. FRANCOIS COUNTY:

GENERAL HABITAT

TOAD, FOWLER'S

INHABIT RIVER
FLOODPLAINS,
PASTURES AND SHORES
OF LAKES AND
RIVERS. PREFER SANDY
SOIL.

COPPERHEAD, OSAGE

OCCUR ON SHADY,
ROCKY HILLSIDES NEAR
WATER IN FORESTS
WITH LEAF LITTER AND
GROUND DEBRIS.

LIZARD, WESTERN
SLENDER GLASS

OCCURS IN GRASSLAND.

COMMENTS ON OCCURREN
IN MISSOURI

RANGE OVER ALL OF
EASTERN AND SOUTHERN
MO *01*

OCCURS IN MOST OF MO
EXCEPT SOUTHEAST
LOWLANDS AREA AND
EXTREME
NORTH-CENTRAL
COUNTIES *01*

LIKELY TO OCCUR
STATE-WIDE *05*. NOT
MANY HAVE BEEN
COLLECTED, ARE
COMMON ON NATIVE
PRAIRIE & OLD FIELDS
13

RACERUNNER,
SIX-LINED

OCCUR IN SPARSELY
WOODED AREAS,
FIELDS, MARGINS OF
THICKETS AND CEDAR
GLADES. TYPICALLY
NEST IN ERODED SOIL
COVERED WITH LIGHT
TO MODERATE
VEGETATION.

OCCURS ALONG EAST
EDGE OF STATE & IN
SOUTHEAST MO *01,02*
WIDE ZONE OF
INTERGRADATION WITH
C. SEXLINEATUS
VIRIDIS
IN CENTRAL MO
01,02

SKINK, BROADHEAD

INHABIT WOODLAND AND
WOODLAND EDGE.

SKINK, SOUTHERN COAL

INHABIT MOIST
WOODLANDS NEAR
STREAMS, RIVERS AND
SLOUGHS.

OCCURS IN THE OZARK
REGION *01*

SLIDER, RED-EARED

OCCURS IN SWAMPS,
MARSHES, WATERHOLES,
SLOUGHS, DITCHES,
STREAMS, PONDS,
LAKES OR RESERVOIRS
WITH MODERATE TO
DENSE VEGETATION AND
LITTLE OR NO
CURRENT.

NEARLY STATEWIDE
02

SNAKE, DIAMONDBACK
WATER

INHABITS GRASSY OR
WEEDY AREAS NEAR
BACKWATERS, SLOUGHS,

NEARLY STATEWIDE,
BUT ERRATIC &
APPARENTLY

DITCHES, MARSHES,
SWAMPS, PONDS AND
STREAMS.

DISCONTINUOUS
01.

ILIKELY TO OCCUR IN ST. FRANCOIS COUNTY:

	GENERAL HABITAT	COMMENTS ON OCCURRENCE IN MISSOURI
----- SNAKE, FLATHEAD	PREFER ROCK OUTCROPS IN SANDY SOIL IN OAK-HICKORY FOREST. ALSO USE CEDAR GLADES AND SPARSELY WOODED ROCK LEDGES ABOVE STREAMS.	OCCURS SOUTH OF MO RIVER, NO RECORDS FROM BOOTHEEL REGION *01*
SNAKE, GRAHAM'S CRAYFISH	USE STREAMS, PONDS, LAKES, RESERVOIRS, MEADOWS AND RIVER VALLEYS.	STATEWIDE IN SUITABLE HABITATS *01*.
SNAKE, GREAT PLAINS RAT	INHABIT GRASSLAND, FOREST EDGE, TIMBERED HILLSIDES AND CEDAR GLADES.	OCCUR IN THE OZARK REGION AND S.W. PRAIRIE REGION OF THE STATE *01*
SNAKE, MIDLAND WATER	INHABIT MARSHES AND STREAMS.	OCCUR IN SOUTH-FLOWING WATERSHED OF THE OZARK REGION *01*
SNAKE, MISSISSIPPI RINGNECK	OCCUR UNDER STONES, BARK, AND LEAF LITTER ON TIMBERED HILLSIDES, IN RAVINES OR IN FIELDS.	OCCUR IN S.E. LOWLANDS OF STATE. TEND TO BE MORE IN THE TRANSITION ZONE BETWEEN THE OZARKS AND THE LOW-LANDS RATHER THAN IN THE ALLUVIAL LOWLANDS PROPER *01*
SNAKE, NORTHERN WATER	PREFER CLEAR, SHALLOW STREAMS WITH ROCK BOTTOM. ALSO USE MARSHES, SWAMPS, AND BORDERS OF LAKES.	OCCUR THROUGHOUT STATE EXCEPT FOR SOUTH-FLOWING WATERSHEDS OF THE OZARKS *01*
SNAKE, RED MILK	INHABIT SPARSELY TIMBERED LIMESTONE LEDGES, ROCKY HILLSIDES, AND OLD FIELDS OR FOREST EDGE WITH COARSE ROCKY SOIL.	LIKELY STATEWIDE.*02*
SNAKE, ROUGH EARTH	INHABITS ROCKY WOODED HILLSIDES IN OPEN WOODLAND AND WOODLAND EDGE.	OCCURS IN SOUTHEAST & SOUTH-CENTRAL MO, AND IN EXTREME SW CORNER OF STATE *01*
RATTLESNAKE, TIMBER	INHABIT TIMBERED ROCK LEDGES OVERGROWN WITH BRUSH.	OCCURS STATEWIDE *01*

ILIKELY TO OCCUR IN ST. FRANCOIS COUNTY:

	GENERAL HABITAT	COMMENTS ON OCCURRENCE IN MISSOURI
----- SNAKE, WESTERN RIBBON	OCCUR ALONG EDGE OF SWAMPS, LAKES, DITCHES, STREAMS AND	OCCUR STATE-WIDE *01*

SNAKE, WESTERN WORM MARSHY AREAS.
 OCCURS IN DAMP,
 HILLY FORESTS,
 WOODLAND EDGE AND
 GRASSY
 HILLSIDES. ARE FOUND
 UNDER ROCKS, LOGS,
 AND STUMPS, OR IN
 LOOSE SOIL.
 SOFTSHELL, EASTERN SPINY OCCUR IN STREAMS,
 PONDS, LAKES OR
 RESERVOIRS. REQUIRE
 SOFT BOTTOMS WITH
 AQUATIC VEGETATION.
 LAY EGGS IN SANDY
 SOIL OR GRAVEL
 BANKS.
 SOFTSHELL, MIDLAND SMOOTH OCCUR IN PONDS,
 LAKES, RESERVOIRS OR
 STREAMS. PREFER MUD
 OR SAND BOTTOMS.
 NEST ON SANDBARS,
 MUDFLATS, ISLANDS OR
 BANKS.
 SOFTSHELL, SPINY OCCUR IN SLOUGHS,
 MARSHES, STREAMS,
 PONDS, LAKES OR
 RESERVOIRS WITH SOFT
 MUD OR SILT BOTTOMS.
 PREFER AREAS
 WITH SANDBARS OR
 MUDFLATS. NEST IN
 SAND OR SOFT SOIL.
 TURTLE, COMMON MUSK OCCUR IN SWAMPS,
 MARSHES, DITCHES,
 STREAMS, PONDS,
 LAKES
 AND RESERVOIRS WITH
 MODERATE TO DENSE
 VEGETATION AND
 LITTLE
 OR NO CURRENT. NEST
 IN WELL-DRAINED
 SOIL, OFTEN UNDER
 LOGS,
 STUMPS OR DEBRIS.

OCCURS STATE-WIDE
 05

DISTRIB. ALONG MISS.
 RIVER, 1-2 COUNTIES
 INTO STATE
 CORRESPONDS TO ZONE
 OF INTERGRADATION OF
 SPECIES WITH
 WESTERN SPINY
 SOFTSHELL *03*
 PRESUMED TO BE
 STATEWIDE

TYPICAL POPULATIONS
 OF HARTWEGI ARE
 CONFINED TO W. 1/2
 OF
 STATE. THE
 POPULATION OF A
 BROAD ZONE
 PARALLELING THE
 MISS. RIVER
 EXHIBIT
 INTERGRADATION WITH
 T.S. SPINIFER *01*
 GENERALLY S. OF MO.
 R., AND N. IN MISS.
 VALLEY INTO IOWA.
 05

ILIKELY TO OCCUR IN ST. FRANCOIS COUNTY:

GENERAL HABITAT

 TURTLE, COMMON
 SNAPPING

 INHABIT SWAMPS,
 MARSHES, SLOUGHS,
 PONDS, LAKES AND
 RESERVOIRS MUD OR
 SILT BOTTOMS AND
 MODERATE TO DENSE
 VEGETATION. NEST IN
 WELL-DRAINED SOIL
 WITH SHORT,
 SPARSE VEGETATION.
 INHABIT STREAMS WITH
 ROCK BOTTOMS AND
 RESERVOIRS. REQUIRE
 ABUNDANT AQUATIC
 VEGETATION. NEST IN
 SOFT SOIL OR CLEAN

COMMENTS ON OCCURREN
 IN MISSOURI

 STATEWIDE *02,05*

TURTLE, COMMON MAP

STATEWIDE EXCEPT N.
 1/4 OF STATE *01,02*

TURTLE, MISSISSIPPI MAP	SAND AWAY FROM BEACHES. OCCURS IN SLOUGHS, STREAMS, PONDS, LAKES AND RESERVOIRS WITH DENSE AQUATIC VEGETATION.	STATEWIDE EXCEPT EXTREME NE CORNER OF STATE *01,02*
TURTLE, ORNATE BOX	OCCUR IN GRASSLAND, OPEN WOODLAND AND CEDAR GLADES NEAR RIVERS OR STREAMS.	STATEWIDE, EXCEPT FOR SE CORNER OF STATE *01,02*
TURTLE, WESTERN PAINTED	OCCURS IN SLOUGHS, WATERHOLES, DITCHES, STREAMS, PONDS, LAKES AND RESERVOIRS WITH MUD OR SAND BOTTOMS, MODERATE TO DENSE AQUATIC VEGETATION AND LITTLE OR NO CURRENT. NEST IN SHRUBBY FIELDS, ROADSIDES, FLOODPLAINS AND PASTURES.	STATEWIDE, EXCEPT S. BORDER & SE LOWLAND. *02*
COOTER, MISSOURI RIVER	OCCUR IN SWAMPS, WATERHOLES, SLOUGHS, DITCHES, STREAMS, PONDS, LAKES AND RESERVOIRS. PREFER MUD BOTTOM, MODERATE TO DENSE AQUATIC VEGETATION, AND LITTLE OR NO CURRENT.	UNCOMMON IN S. MO. *02*

1. LIKELY TO OCCUR IN ST. FRANCOIS COUNTY:

	GENERAL HABITAT	COMMENTS ON OCCURREN IN MISSOURI
BITTERN, AMERICAN	OCCUR IN MARSHES, WET MEADOWS AND SLOUGHS WITH EMERGENT VEGETATION AND PERMANENT WATER 8-13 INCHES DEEP.	OCCURS STATEWIDE *01* RARE SUMMER RES., UNCOMMON TRANSIENT *02*
BLACKBIRD, RUSTY	OCCUR IN DENSE COVER NEAR TREE-BORDERED MARSHES, SWAMPS AND SWAMPY WOODLANDS.	UNCOMMON TRANSIENT, RARE (UNCOMMON IN S.E.) WINTER RESIDENT *01*
BOBOLINK	INHABIT PERMANENT GRASSLAND WITH DENSE VEGETATION, USUALLY NEAR STANDING WATER.	UNCOMMON TRANSIENT, RARE SUMMER RESIDENT IN NORTHWEST *01*
COOT, AMERICAN	PREFERRED MARSHES DOMINATED BY ROBUST EMERGENT VEGETATION WITH HIGH INTERSPERSION OF WATER AND ERECT STEMS. REQUIRE STABLE WATER LEVELS DURING NESTING SEASON.	COMMON TRANSIENT, RARE SUMMER RESIDENT & SUMMER VISITANT, UNCOMMON WINTER RES. IN SOUTH MO *01*
CREEPER, BROWN	OCCURS IN DECIDUOUS AND CONIFEROUS FORESTS, AND BOTTOMLAND	COMMON TRANSIENT, UNCOMMON WINTER RESIDENT *02*

HARDWOODS.

DOWITCHER,
LONG-BILLED

OCCUR IN GRASSLAND
ADJACENT TO PONDS,
LAKES, RESERVOIRS,
STREAMS AND
WATERHOLES WITH MUD
BOTTOMS AND
SHORELINES,
SHALLOW WATER AND
EMERGENT VEGETATION.
OCCURS IN MARSHES
AND NEAR PONDS,
LAKES AND RESERVOIRS
WITH
SHALLOW WATER. ALSO
FORAGE ON MUDFLATS
AND SANDFLATS.

TRANSIENT, UNCOMMON
01.

DOWITCHER,
SHORT-BILLED

TRANSIENT, UNCOMMON
01.

1. LIKELY TO OCCUR IN ST. FRANCOIS COUNTY:

GENERAL HABITAT

COMMENTS ON OCCURREN IN MISSOURI

EAGLE, BALD

DURING WINTER
CONCENTRATE NEAR
RIVERS WITH OPEN
WATER AND IN
AREAS WITH LARGE
NUMBERS OF WINTERING
WATERFOWL. REQUIRE
PERCH
SITES NEAR SHORE.
PREFER AREAS WITH
LIMITED HUMAN
ACTIVITY.

POSSIBLE STATEWIDE
DISTRIBUTION DURING
WINTER *01*

EAGLE, GOLDEN

OCCUR IN OPEN
MEADOWS, FIELDS OR
BALD KNOBS
INTERSPERSED
WITH TIMBER.

POSSIBLE STATEWIDE
DISTRIBUTION DURING
WINTER *01*

EGRET, SNOWY

INHABIT MARSHES,
SWAMPS AND LOWLAND
FORESTS WITH SHRUBS
AND
ROBUST EMERGENT
VEGETATION. PREFER
VEGETATION AVERAGE
3.92 M

UNCOMMON SUMMER
RESIDENT *01* MOST
NESTING OCCURS IN SE
MO *01,02*

FINCH, PURPLE

TALL AND NEST TREES
AVG. 6.77 CM DBH.
OCCUR IN CONIFEROUS
FORESTS AND
THICKETS.

UNCOMMON WINTER
RESIDENT IN SOUTH
MO, RARE WINTER RES.
IN

FLYCATCHER, LEAST

OCCURS IN OPENINGS
IN DECIDUOUS AND
MIXED FORESTS.
PREFER
WELL-DEVELOPED
CANOPY AND LARGE,
TALL TREES.

NORTH MO *01*
COMMON TRANSIENT,
CASUAL SUMMER
VISITANT. *02,03*

GOLDENEYE, COMMON

OCCUR IN MARSHES AND
STREAMS, PONDS,
LAKES AND RESERVOIRS
WITH
SUBMERGED AQUATIC

COMMON TRANSIENT,
ACCIDENTAL SUMMER
VISITANT *01*.
COMMON
WINTER RESIDENT *03*

SANDPIPER,
BUFF-BREASTED

VEGETATION. REQUIRE
WATER < 2 M DEEP FOR
FEEDING.
INHABITS GRASSLAND
AND CROP FIELDS
ADJACENT TO MARSHES,
STREAMS OR
WATERHOLES.

IN MISSOURI
TRANSIENT RARE *01*

ILIKELY TO OCCUR IN ST. FRANCOIS COUNTY:

GENERAL HABITAT

COMMENTS ON OCCURREN
IN MISSOURI

GOOSE, LESSER SNOW

INHABITS MARSHES,
PONDS, LAKES AND
RESERVOIRS WITH
AQUATIC
VEGETATION. FORAGE
IN CROP FIELDS AND
PASTURES.

COMMON MIGRANT AND
COMMON WINTERING
SPECIES *21*

GOOSE, GREATER
WHITE-FRONTED

OCCURS IN MARSHES,
WATERHOLES, PONDS,
LAKES AND RESERVOIRS
WITH AQUATIC
VEGETATION. FORAGE
IN CROP FIELDS AND
PASTURES.

UNCOMMON TRANSIENT
IN WEST, RARE
TRANSIENT IN EAST,
CASUAL SUMMER
VISITANT AND WINTER
RESIDENT *08*

GREBE, PIED-BILLED

OCCUR IN MARSHES,
BOGS, SLOUGHS,
WATERHOLES, PONDS,
LAKES AND
RESERVOIRS WITH
SHALLOW WATER AND
DENSE STANDS OF
EMERGENT
VEGETATION. PREFER
PONDS < 7 HA.

COMMON TRANSIENT,
UNCOMMON WINTER
RESIDENT, RARE
SUMMER
RESIDENT *01*

GROUSE, RUFFED

OCCUR IN EARLY
SUCCESSIONAL FOREST
WITH HIGH NUMBER OF
WOODY
PLANT STEMS PER
ACRE. LOW SHRUB AND
HERB. GROUND COVER
ARE
SPARSE IN DRUMMING
AND NESTING AREAS,
DENSE IN BROOD &
WINTER
HABITAT. CONTIGUOUS
FOREST WITH EARLY
SUCCESSIONAL STAGE
AREAS
AT 1/8 TO 1/4 MILE
INTERVALS IS
DESIRABLE.

RELEASE SITES HAVE
BEEN LOCATED IN THE
FOLLOWING COUNTIES:
ADAIR, ANDREW,
ATCHISON, BOLLINGER,
BUCHANAN, CARTER,
CRAWFORD,
HOLT, HOWELL,
LINCOLN, LIVINGSTON,
MADISON, MERCER,
OREGON,
OZARK, PIKE,
PULASKI, PUTNAM,
RALLS, RAY,
REYNOLDS, RIPLEY,
STE. GENEVIEVE,
SCHUYLER, SCOTT,
SHANNON, STODDARD,
STONE,
SULLIVAN,
WASHINGTON, WAYNE
28

GOSHAWK, NORTHERN

INHABITS MIXED
WOODLANDS AND OLD
FIELDS INTERSPERSED
WITH
AGRICULTURAL LAND.
SNAGS ENHANCE
HABITAT.

POSSIBLE STATEWIDE
DISTRIBUTION.
USUALLY WINTER
RESIDENT
RARE *01*

ILIKELY TO OCCUR IN ST. FRANCOIS COUNTY:

	GENERAL HABITAT	COMMENTS ON OCCURRENCE IN MISSOURI
JUNCO, DARK-EYED	OCCUR IN SCRUB LAND, GRASSY AREAS, CROP FIELDS AND RESIDENTIAL AREAS.	COMMON WINTER RESIDENT, DOES NOT BREED IN MO *01*
KINGLET, GOLDEN-CROWNED	OCCUR IN CONIFEROUS OR MIXED WOODLANDS, ORCHARDS AND RESIDENTIAL AREAS WITH THICKETS AND TANGLED WEEDY GROWTH.	COMMON WINTER RESIDENT - STATEWIDE *02*
KINGLET, RUBY-CROWNED	PREFERS SWAMPY THICKETS ALONG STREAMS AND AROUND BOGS AND PONDS.	COMMON TRANSIENT-STATEWIDE, RARE WINTER RESIDENT*11*
MERGANSER, COMMON	OCCUR IN MARSHES, PONDS, LAKES, RESERVOIRS AND STREAMS. PREFER CLEAR, SHALLOW WATER. REQUIRE ICE-FREE WATER IN WINTER.	COMMON WINTER RESIDENT, ACCIDENTAL SUMMER VISITANT *01* COMMON TRANSIENT *03*
MERGANSER, HOODED	INHABIT MARSHES, FLOODED TIMBER AND WOODED SHORES OF STREAMS AND LAKES. PREFER AREAS WITH STANDING DEAD TREES, SNAGS AND STUMPS. PREFER NEST TREE DBH > 12 INCHES.	COMMON TRANSIENT, SUMMER RESIDENT IN EAST MO, RARE WINTER RESIDENT. MAINLY NEST IN MINGO SWAMP & AT TED SHANKS WILDL. AREA.*03*
OSPREY	ARE ASSOCIATED WITH STREAMS, SWAMPS, PONDS, LAKES AND RESERVOIRS. NEST IN TALL TREES, ON UTILITY POLES OR NEST PLATFORMS NEAR WATER.	UNCOMMON TRANSIENT, POSSIBLY ACCIDENTAL SUMMER RESIDENT IN SOUTH *01*
OWL, NORTHERN SAW-WHET	OCCUR IN MIXED DECIDUOUS AND CONIFEROUS FOREST, AND ALONG FOREST EDGE.	OCCURS STATEWIDE *02,17*
PHALAROPE, RED-NECKED	OCCUR ON MARSHES, PONDS, LAKES AND RESERVOIRS.	IN MISSOURI TRANSIENT, RARE, WINTER RESIDENT, BETWEEN DECEMBER 15 AND FEBRUARY 20. ACCIDENTAL, WEST *01*

ILIKELY TO OCCUR IN ST. FRANCOIS COUNTY:

	GENERAL HABITAT	COMMENTS ON OCCURRENCE IN MISSOURI
PHALAROPE, WILSON	OCCUR IN MARSHES, SLOUGHS, PONDS, LAKES AND RESERVOIRS WITH SHALLOW WATER, ADJACENT TO GRASSLAND.	IN MISSOURI TRANSIENT, COMMON WEST, UNCOMMON EAST, FORMERLY IN MISSOURI AS A SUMMER RESIDENT, CASUAL NORTH.*01*
PLOVER, AMERICAN	OCCUR IN GRASSLAND	IN MISSOURI

GOLDEN	OR CROPLAND ADJACENT TO WATERHOLES, PONDS, LAKES, RESERVOIRS, STREAMS OR MARSHES.	TRANSIENT, COMMON *01*
PLOVER, SEMIPALMATED	OCCURS ON SHORES OF LAKES AND RIVERS AND ON MUDFLATS. PREFERS MUDFLATS	COMMON TRANSIENT IN MO *01*
REDSTART, AMERICAN	INTERSPERSED WITH SHALLOW POOLS, WHERE VEGETATION IS ABSENT OR SPARSE. INHABIT POLE AND MATURE SECOND-GROWTH HARDWOODS WITH ABUNDANT HERBACEOUS GROUND COVER. PREFER PRESENCE OF TREES > 38 CM DBH.	SUMMER RESIDENT, UNCOMMON *01*
SANDPIPER, BAIRD'S	OCCUR IN MARSHES AND ON SHORES OF STREAMS, PONDS, LAKES AND RESERVOIRS. FEED ON OPEN MUDFLATS.	UNCOMMON TRANSIENT *01*
SANDPIPER, LEAST	INHABIT MARSHES, SLOUGHS, AND SHORES OF PONDS, LAKES, RESERVOIRS. AND STREAMS. FORAGE IN WATER, MAT VEGETATION AND MUDFLATS. PREFER WATER < 2.5 CM DEEP AND HERBACEOUS VEGETATION SPARSE OR ABSENT.	COMMON TRANSIENT, ACCIDENTAL WINTER RESIDENT IN SOUTHEAST MISSOURI *01*

ILIKELY TO OCCUR IN ST. FRANCOIS COUNTY:

	GENERAL HABITAT	COMMENTS ON OCCURREN IN MISSOURI
SANDPIPER, PECTORAL	OCCUR IN MARSHES AND ON SHORES OF WATERHOLES, PONDS, LAKES AND RESERVOIRS. PREFER WATER < 3.5 CM DEEP AND ABSENT OR SPARSE VEGETATION < 3.5 CM TALL.	COMMON TRANSIENT *01*
SANDPIPER, SEMIPALMATED	OCCUR ALONG MUDDY OR SANDY SHORES OF WATERHOLES, PONDS, LAKES AND RESERVOIRS. PREFER WATER < 2.5 CM DEEP AND NO HERBACEOUS VEGETATION.	COMMON TRANSIENT *01*
SANDPIPER, SPOTTED	OCCUR IN SLOUGHS AND ALONG BANKS OF STREAMS, PONDS, LAKES	IN MISSOURI SUMMER RESIDENT, UNCOMMON *01*.

SAPSUCKER,
YELLOW-BELLIED

SISKIN, PINE

SNIFE, COMMON

AND RESERVOIRS. NEST
IN GRASS OR ROCKS.
FORAGE IN AREAS WITH
VEGETATION SPARSE OR
ABSENT, WHERE WATER
IS < 2.5 CM DEEP.

INHABIT MATURE
FORESTS AND
RESIDENTIAL AREAS.
FORAGE ON LARGE
(13-25 CM) LIMBS OF
LIVE TREES.
OCCUR IN CONIFEROUS
AND MIXED FORESTS.

OCCUR IN WET
MEADOWS, MARSHES AND
MARSHY LAKES WITH
LOW
WOODY GROWTH AND
OPEN LAND NEARBY.
USUALLY OCCUR IN WET
AREAS WITH DENSE
VEGETATION.

UNCOMMON WINTER
RESIDENT, CASUAL
SUMMER RESIDENT IN
NORTHEAST *03*

UNCOMMON WINTER
RESIDENT, CASUAL
SUMMER RESIDENT *01*
TRANSIENT, COMMON,
WINTER RESIDENT,
RARE

ILIKELY TO OCCUR IN ST. FRANCOIS COUNTY:

GENERAL HABITAT

SPARROW, CHIPPING

INHABITS OLD FIELDS,
OPEN MIXED
WOODLANDS, EDGE,
CLEARINGS,
ORCHARDS AND
RESIDENTIAL AREAS.
PREFERRED FORAGING
AREAS

SPARROW,
CLAY-COLORED

HAVE ABUNDANT WEEDS.
OCCURS ALONG BORDERS
OF FIELDS, WOODLAND,
ROADS AND STREAMS,
AND IN
GRAIN FIELDS.

SPARROW, FIELD

INHABIT OLD FIELDS,
EDGE AND GRASSLAND
AND CROPLAND WITH
>85%
HERBACEOUS GROUND
VEGETATION. IN
WOODED AREAS PREFER
CANOPY HEIGHT
< 8 FEET.

SPARROW, FOX

INHABIT THICKETS,
EDGE, DENSE WEEDY
GROWTH ALONG STREAMS
AND

SPARROW, LECONTE'S

SWAMPY THICKETS.
INHABITS GRASSLAND
AND CROPLAND.

SPARROW,
SHARP-TAILED
SPARROW, AMERICAN

OCCUR IN GRASSLAND
AND CROPLAND.
OCCUR IN WOODLAND,

COMMENTS ON OCCURREN
IN MISSOURI

COMMON SUMMER
RESIDENT - STATEWIDE
02

UNCOMMON
TRANSIENT-WEST,
RARE-EAST,
ACCIDENTAL WINTER
RES.

IN THE EAST.*02*
COMMON SUMMER
RESIDENT-STATEWIDE,
UNCOMMON WINTER
RESIDENT
IN SOUTH,
CASUAL-NORTH.*02*

UNCOMMON WINTER
RESIDENT *01*

COMMON TRANSIENT
STATEWIDE, UNCOMMON
WINTER
RESIDENT-SOUTH
RARE WINT.
RES.-NORTH.*02*
RARE TRANSIENT -
STATEWIDE *02*
COMMON WINTER

TREE	OLD FIELDS AND FOREST EDGE. MAY FORAGE IN CROPLAND.	RESIDENT - STATEWIDE
SPARROW, WHITE-CROWNED	INHABIT BRUSHY THICKETS AND DENSE PATCHES OF WEEDS.	UNCOMMON WINTER RES. IN NW MO, COMMON WINTER RES. ELSEWHERE IN STATE *01*
SPARROW, WHITE-THROATED	OCCUR IN BRUSHY AREAS AND EDGE WITH LEAF LITTER.	COMMON WINTER RES. IN SOUTH MO, RARE WINTER RES. IN NORTH MO, COMMON TRANSIENT, ACCIDENTAL SUMMER VISITANT *01*

ILIKELY TO OCCUR IN ST. FRANCOIS COUNTY:

	GENERAL HABITAT	COMMENTS ON OCCURREN IN MISSOURI
THRUSH, GRAY-CHEEKED	INHABIT UPLAND WOODLANDS AND THICKETS WITH DEEP LAYER OF LEAF LITTER.	COMMON TRANSIENT-STATEWIDE. *02,05,06*
THRUSH, HERMIT	INHABIT THICKETS, ORCHARDS, WOODLANDS AND BORDERS OF WOODED SWAMPS, ESPECIALLY IN AREAS OF DENSE, YOUNG DECIDUOUS-CONIFEROUS GROWTH.	UNCOMMON TRANSIENT, WINTER RESIDENT-OZARKS *02*
THRUSH, SWAINSON'S	INHABITS WOODLAND EDGE AND RESIDENTIAL AREAS.	COMMON TRANSIENT- STATEWIDE *02*
VEERY	OCCURS IN DAMP DECIDUOUS FORESTS WITH LUSH UNDERSTORY AND LEAF LITTER.	UNCOMMON TRANSIENT-EAST, RARE TRANSIENT-WEST.*02*
VIREO, BELL'S	INHABIT THICKETS, ORCHARDS, OLD FIELDS, SHRUBBY GROVES AND BOTTOMLAND FOREST EDGE. PREFER GROUND VEGETATION > .4 M, RELATIVELY DENSE SMALL WOODY STEMS AND CANOPY HEIGHT 2-8M.	SUMMER RESIDENT , UNCOMMON *01*
VIREO, PHILADELPHIA	OCCUR IN UPLAND AND BOTTOMLAND FORESTS, OLD FIELDS AND THICKETS.	TRANSIENT RARE *01*
VIREO, SOLITARY	OCCUR IN OPEN WOODLAND AND WOODLAND EDGE.	TRANSIENT UNCOMMON , WINTER RESIDENT ACCIDENTAL *01*
WARBLER, BLACK-AND-WHITE	OCCURS IN POLE TO MATURE UPLAND HARDWOODS, AND OCCASIONALLY IN LOWLAND FORESTS. CONTIGUOUS FOREST CANOPY, DENSE GROUND VEGETATION, LITTER, AND DENSE UNDERSTORY ARE IMPORTANT.	UNCOMMON SUMMER RESIDENT - STATEWIDE *02*

WARBLER,
BLACK-THROATED GREEN

OCCURS IN DECIDUOUS
FOREST WITH DENSE
UNDERSTORY.

TRANSIENT, COMMON
01

ILIKELY TO OCCUR IN ST. FRANCOIS COUNTY:

GENERAL HABITAT

COMMENTS ON OCCURREN
IN MISSOURI

WARBLER,
BLACKBURNIAN

OCCURS IN MATURE
UPLAND HARDWOODS AND
LARGE CONIFERS.

TRANSIENT, UNCOMMON
01, ACCIDENTAL
SUMMER VISITANT
09.

WARBLER, BLACKPOLL

OCCURS IN OLD FIELDS
AND UPLAND
HARDWOODS.

TRANSIENT, COMMON
01

WARBLER,
CHESTNUT-SIDED

OCCURS IN OLD
FIELDS, FOREST EDGE,
HEDGEROWS AND
UNDERGROWTH
OF CUT-OVER TIMBER.

TRANSIENT, COMMON,
FORMERLY A SUMMER
RESIDENT,
(NORTHEAST)
01. SPECIES
FORMERLY BRED IN MO
02,04.
TRANSIENT, RARE *01*

WARBLER, CONNECTICUT

OCCURS IN OLD
FIELDS, WOODLAND AND
SWAMPS.

TRANSIENT, COMMON
01

WARBLER, MAGNOLIA

OCCUR IN DECIDUOUS
FORESTS, FOREST EDGE
AND OLD FIELDS.

WARBLER, NASHVILLE

OCCUR IN MARSHES,
SWAMPS AND DAMP OLD
FIELDS WITH LOW
BRUSHY
GROWTH AND YOUNG
TREES 10-12 FEET
TALL.

TRANSIENT, COMMON,
WINTER RESIDENT,
ACCIDENTAL *01*

WARBLER,
ORANGE-CROWNED

OCCUR IN OLD FIELDS,
CUT-OVER FOREST AND
BRUSHY OPEN
WOODLAND.

TRANSIENT, UNCOMMON
01, CASUAL WINTER
RESIDENT *09*.

WARBLER, PALM

OCCUR IN MARSHES,
GRASSLAND AND FOREST
EDGE.

TRANSIENT, COMMON
(EAST), UNCOMMON
(WEST), WINTER
RESIDENT
ACCIDENTAL (SOUTH)
01.

WARBLER, TENNESSEE

OCCURS IN BOTTOMLAND
FORESTS AND OLD
FIELDS.

TRANSIENT, COMMON,
SUMMER VISITANT,
ACCIDENTAL *01*
TRANSIENT, COMMON
01

WARBLER, WILSON'S

OCCURS IN OLD
FIELDS, FOREST EDGE
AND SWAMPS.

WARBLER,
YELLOW-RUMPED

OCCUR IN OLD FIELDS,
BOTTOMLAND AND
UPLAND FORESTS,
AND SWAMPS.

TRANSIENT, COMMON,
WINTER RESIDENT,
RARE (SOUTH) *01*

WATERTHRUSH,
NORTHERN

OCCUR IN SWAMPS AND
RIPARIAN WOODLANDS
WITH DENSE
SHRUBS AND 47.3%
HERBACEOUS
VEGETATION.

TRANSIENT, UNCOMMON
01

ILIKELY TO OCCUR IN ST. FRANCOIS COUNTY:

GENERAL HABITAT

COMMENTS ON OCCURREN
IN MISSOURI

WREN, WINTER

OCCUR IN RIPARIAN
FORESTS WITH BRUSHY

STATEWIDE DURING
WINTER MONTHS *19*

YELLOWLEGS, GREATER	AREAS. OCCURS IN MARSHES, SLOUGHS, AND ALONG SHORES OF STREAMS, PONDS, LAKES AND RESERVOIRS. FORAGE IN SHALLOW WATER AND IN AREAS WITH SPARSE OR ABSENT VEGETATION.	IN MISSOURI TRANSIENT COMMON *01*
BAT, BIG BROWN	OCCUR IN WOODLANDS WITH SNAGS 9-36 IN. DBH. ALSO INHABIT BUILDINGS AND CULVERTS. FORAGE ALONG WATERCOURSES.	LIKELY TO OCCUR STATEWIDE *02*
BAT, RAFINESQUE'S BIG-EARED	INHABIT CAVES DURING WINTER. IN SUMMER, MAY USE HOLLOW TREES LOOSE BARK OF TREES, OR BUILDINGS.	HAS BEEN TAKEN IN SE MO IN SPRING AND POSSIBLY OCCURS DURING THE REST OF THE YEAR *03*
BAT, EVENING	INHABIT DECIDUOUS WOODLANDS ADJACENT TO WATER. FORAGE OVER CLEARINGS OR PASTURES. USE SNAGS OR DEN TREES > 9 IN. DBH.	
BAT, HOARY	INHABIT WOODLANDS WITH OPENINGS, FARMYARDS, PARKS AND YARDS.	RELATIVELY RARE THROUGHOUT STATE. *02*
BAT, RED	INHABIT OPEN WOODLANDS, FOREST EDGE, FENCEROWS, ORCHARDS, PARKS AND RESIDENTIAL YARDS.	02 OCCURS THROUGHOUT STATE, MOST COMMON IN OZARK HIGHLAND. *02*
LEMMING, SOUTHERN BOG	OCCUR IN MOIST AREAS SUCH AS MARSHES, BOGS, WET MEADOWS, AND MOIST WOODLANDS. NEED GOOD ACCUMULATION OF MATTED VEGETATION OR LEAF MOLD.	OCCURS IN ALL OF MO EXCEPT EXTREME SW CORNER *01*

ILIKELY TO OCCUR IN ST. FRANCOIS COUNTY:

	GENERAL HABITAT	COMMENTS ON OCCURREN IN MISSOURI
MOUSE, MEADOW JUMPING	PREFER OPEN, MOIST, GRASSY HABITAT SUCH AS SHRUBBY OR WEEDY FIELDS, HAYFIELDS, FENCEROWS, WOODLAND EDGE AND GRASSY AREAS AT EDGES OR STREAMS, MARSHES OR PONDS.	PRESUMABLY OCCURS THROUGHOUT MO EXCEPT IN THE MISSISSIPPI LOWLANDS *01* UNEVENLY DISTRIBUTED THROUGHTOUT RANGE, POP. DENSITIES VARY FROM 2-26 PER ACRE *01*
MOUSE, WESTERN HARVEST	OCCUR IN GRASSY OR WEEDY AREAS WITH DENSE GROUND VEGETATION. PREFER SITES NEAR WATER.	OCCURS THROUGHOUT STATE EXCEPT EXTREME S.W. CORNER *01*

MYOTIS, GRAY

REQUIRE UNDISTURBED
CAVES. FORAGE OVER
STREAMS, RIVERS AND
RESERVOIRS. A
CORRIDOR OF MATURE
TREES BETWEEN CAVES
AND

OCCURS PRIMARILY IN
THE OZARK HIGHLANDS,
BUT OCCURS
THROUGHOUT MO WHERE
THERE ARE CAVES *01*

MYOTIS, INDIANA

FORAGING SITES IS
IMPORTANT.
DURING WINTER
HIBERNATE IN
LIMESTONE CAVES.
SUMMER HABITAT
INCLUDES MATURE
RIPARIAN AND
ADJACENT UPLAND
FORESTS. FULL FOREST
CANOPY WITH OPEN
UNDERSTORY

LIKELY TO OCCUR
STATEWIDE *01*

MYOTIS, KEEN'S

PREFERRED. SNAGS AND
CAVITY TREES (>9 IN
DBH) ARE IMPORTANT.
OCCUR IN DECIDUOUS
UPLAND OR RIPARIAN
WOODLANDS. USE SNAGS
OR DEN TREES 9-36
IN. DBH WITH LOOSE
BARK.

OCCUR STATEWIDE
01,02

MYOTIS, LITTLE BROWN

INHABIT CAVES DURING
WINTER. IN SUMMER
USE SNAGS OR DEN
TREES 9-36 IN. DBH.
USUALLY ARE FOUND
NEAR WATER.

STATEWIDE
OCCURRENCE *01,02*

ILIKELY TO OCCUR IN ST. FRANCOIS COUNTY:

GENERAL HABITAT

COMMENTS ON OCCURREN
IN MISSOURI

MYOTIS, SMALL-FOOTED

DURING SUMMER
INHABIT CAVITIES AND
CREVICES IN BANKS
AND
TREES, USUALLY
WITHIN 2 MILES OF
WATER. FORAGE IN OR
UNDER
TREE CANOPY.

OCCUR IN S.E.
ONE-THIRD OF STATE
11

PIPISTRELLE, EASTERN

INHABIT CAVES, EAVES
OF BUILDINGS, OR
PROTECTED PARTS OF
CLIFFS, PREFERRABLY
NEAR WATER. MAY USE
SNAGS OR DEN TREES
9-36 IN. CBH.
FORAGE OVER PASTURE
WITH WOODLAND
BORDER.

OCCURS THROUGHOUT MO
ALL YEAR. *02*

RAT, EASTERN WOOD

OCCUR IN UPLAND AND
LOWLAND FORESTS, OLD
FIELDS, EDGE AND
HEDGEROWS WITH DENSE
COVER AND <40%
HERBACEOUS GROUND
VEGETATION. CLIFFS
AND LEDGES ENHANCE
HABITAT.

OCCURS IN SOUTHERN
HALF OF STATE *01*

RAT, HISPID COTTON

INHABIT DENSE GRASSY
FIELDS, WEEDY

FIRST RECORDED FROM
MO IN 1945 *01*

RAT, MARSH RICE	ROADSIDES AND WASTE BORDERS OF CROP FIELDS. PREFER TALL (.25M) MONOCOT HERBACEOUS VEGETATION WITH HEAVY MAT OF DEAD GRASS AND LITTER. OCCUR IN MARSHY AREAS WITH DENSE GROUND COVER, GRAIN FIELDS AND DITCHES WITH STANDING WATER AND EMERGENT HERBACEOUS VEGETATION. INHABIT MARSHY AREAS, OPEN OR BRUSHY FIELDS WITH DENSE GRASSY COVER AND TIMBERED AREAS	OCCURS IN MISSISSIPPI LOWLANDS *01* MAY OCCUR IN S.W. CORNER OF STATE *02*
SHREW, LEAST	INHABIT MARSHY AREAS, OPEN OR BRUSHY FIELDS WITH DENSE GRASSY COVER AND TIMBERED AREAS	PROBABLY OCCURS THROUGHOUT MO *01*
ILIKELY TO OCCUR IN ST. FRANCOIS COUNTY:		
SHREW, SHORT-TAILED	<div data-bbox="488 770 732 795">GENERAL HABITAT</div> <div data-bbox="488 850 813 1646"> OCCUR IN DAMP OR WET LOCATIONS IN FLOODED AREAS WITH HEAVY WEEDY GROWTH, AND IN DECIDUOUS OR MIXED FORESTS. AREAS WITH BRUSHPILES AND RELATIVELY DENSE WOODY VEGETATION PREFERRED. INHABIT OAK-HICKORY AND MIXED PINE-HARDWOODS FORESTS, OLD FIELDS, FOREST EDGE, FENCEROWS AND ORCHARDS. PREFER GRASS HEIGHT 201-300 MM AND DENSITY > 61%. PREFER TIMBER BORDERED BY OPEN LAND, FENCEROWS, AND HEAVILY VEGETATED GULLIES OR STREAMBANKS. OR STREAM BANKS. DENS ARE USUALLY LOCATED ON SLOPES. </div>	<div data-bbox="1049 770 1378 821">COMMENTS ON OCCURREN</div> <div data-bbox="1049 821 1378 900"> IN MISSOURI OCCURS THROUGHOUT STATE *01* </div>
VOLE, WOODLAND	<div data-bbox="488 1119 813 1646"> INHABIT OAK-HICKORY AND MIXED PINE-HARDWOODS FORESTS, OLD FIELDS, FOREST EDGE, FENCEROWS AND ORCHARDS. PREFER GRASS HEIGHT 201-300 MM AND DENSITY > 61%. PREFER TIMBER BORDERED BY OPEN LAND, FENCEROWS, AND HEAVILY VEGETATED GULLIES OR STREAMBANKS. OR STREAM BANKS. DENS ARE USUALLY LOCATED ON SLOPES. </div>	OCCURS STATEWIDE *01*
WOODCHUCK	<div data-bbox="488 1388 813 1646"> OCCUR IN DAMP OR WET LOCATIONS IN FLOODED AREAS WITH HEAVY WEEDY GROWTH, AND IN DECIDUOUS OR MIXED FORESTS. AREAS WITH BRUSHPILES AND RELATIVELY DENSE WOODY VEGETATION PREFERRED. INHABIT OAK-HICKORY AND MIXED PINE-HARDWOODS FORESTS, OLD FIELDS, FOREST EDGE, FENCEROWS AND ORCHARDS. PREFER GRASS HEIGHT 201-300 MM AND DENSITY > 61%. PREFER TIMBER BORDERED BY OPEN LAND, FENCEROWS, AND HEAVILY VEGETATED GULLIES OR STREAMBANKS. OR STREAM BANKS. DENS ARE USUALLY LOCATED ON SLOPES. </div>	OCCURS STATEWIDE, EXCEPT MISS. LOWLAND, WHERE IT IS RARE *02*. NOT NEARLY AS COMMON AS 15-20 YRS. AGO *15*

1RARE-ENDANGERED LIKELY IN ST. FRANCOIS

STATUS

MOONEYE

FROG, WOOD

SPADEFOOT, EASTERN

BITTERN, AMERICAN

EAGLE, BALD

EGRET, SNOWY

GREBE, PIED-BILLED

MYOTIS, GRAY

MYOTIS, INDIANA

MYOTIS, SMALL-FOOTED

NONGAME

STATE RARE

NONGAME

STATE RARE

NONGAME

STATE RARE

NONGAME

STATE ENDANGERED

FEDERAL ENDANGERED

STATE ENDANGERED

NONGAME

RECOVERY PLAN - APPROVED BY

DIRECTOR, FISH & WILDL. SERVICE

NONGAME

STATE ENDANGERED

NONGAME

STATE RARE

FEDERAL ENDANGERED

NONGAME

STATE ENDANGERED

RECOVERY PLAN - APPROVED BY

DIRECTOR, FISH & WILDLIFE SERVICE

FEDERAL ENDANGERED

NONGAME

NONGAME

STATE RARE

FEDERAL CANDIDATE

Impact of Lead on Migratory
Birds in Missouri

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June 1986

ABSTRACT

The Old Lead Belt of Southeastern Missouri (St. Francois and Madison Counties) contains 227 million kilograms of abandoned lead mine tailings. With the rupture of a major tailings dam in 1977, and the continual erosion and seepage of the tailings, the lead has and continues to contaminate the Big River by being deposited in the sediments. In turn, fish, birds, and wildlife have been acquiring the lead by direct ingestion of the sediment, by obtaining the leached lead within the water, or by consumption of lead contaminated food.

BACKGROUND

Fifty-six percent, or 760 million kilograms (838 thousand tons), of the lead used annually in the United States enters the environment (Nriagu 1978), from sources such as automobile emissions, mining activities, factory operations, and lead shot. As the lead enters the environment and becomes available to fish and wildlife, lead poisoning becomes a problem. Lead poisoning affects the nervous system, the transfer of oxygen to the tissues, and the production of hemoglobin, resulting in anemia. The liver and the kidney are the best indicators of acute lead poisoning, while the bones indicate chronic exposure (Adler 1944; Chupp and Dalke 1964). Approximately ninety percent of the lead is eventually deposited in the skeleton (Kendall and Scanlon 1982). Sick avians can be characterized by listlessness, emaciation, and green-stained matted feathers on their vent. Impacted food in the gizzard is common, but starvation continues until death (Rosen and Bankowski 1960).

MISSOURI LEAD MINING

Missouri has been the number one producer of lead in the United States since the 1920's (Wixson 1977). Ore deposits of Galena were discovered in southeast Missouri in the early 1700's in what is known as "The Old Lead Belt" (see map A). In 1848, mines were opened in the southwestern portion of Missouri, near Joplin in what is known as "The Tri-State Mining District". Then in 1955, after the ore deposits in the Old Lead Belt were depleted, "The New Lead Belt", or "Viburnum Trend", became the world's largest lead producing district, with production starting in 1955. By 1970, 74.4% of the entire U.S. lead mine production came from this area (Gale et al. 1973).

Both the New Lead Belt and the Tri-State area do not pose an immediate threat to the environment. According to Czarnecki (1985), lead concentrations in fish from streams adjacent to the mining areas were not significantly different from the control areas. Although these mining operations adversely affect Missouri streams to a certain extent, they have an efficient milling process in removing the lead from the ore and do not represent an immediate concern.

The major problem is the Old Lead Belt, which lies in St. Francois and Madison Counties, 113 km (71 miles) south of St. Louis, Missouri. The area covered consists of 285 sq. km (111 sq. miles), bordered by latitudes $38^{\circ} 00'$ and $37^{\circ} 49' 45''$ (Elliott 1982). Between 1864 and 1972, the mines from the Old Lead Belt generated 227 million kilograms (250 thousand tons) of tailings, with some individual tailings piles covering an area of 648 hectares (1,600 acres). A tailing is the residue that remains after the lead and other metals have been extracted from the ore. Erosion and seepage of lead from these tailings into the Big River in the Old Lead Belt pose a constant threat to the aquatic biota. The Big River is the fourth largest free-flowing stream in the Missouri Ozarks, originating in Iron County and flowing northeast through the Old Lead Belt and entering the Meramac River near Eureka (see map B). Its 240 km (150 mile) length is impacted for at least 60 km (38 miles) by lead mine tailings, covering approximately 1,215 hectares (3,000 acres) and containing up to 26,600 ppm dry weight of lead (Whelan 1983). With the rupture of a major tailings dam at Desloge, Missouri in 1977, 38,230 cubic meters (50,000 cubic yards) of tailings were washed into the Big River (Novak and Hasselwander 1980). According to Schmitt and Finger (1982), the lead deposition extended 96 km (60 miles) downstream from the rupture at Desloge. Lead is biologically available and biochemically active in the Big River ecosystem (Schmitt et al. 1984).

Most lead salts are insoluble in water; therefore, it becomes deposited within the sediment. In the Great Lakes, the sediments are the dominant sinks for lead. For example, in Lake Erie 75 percent of the lead deposited into the lake is retained in the sediments (Great Lakes Science Advisory Board). Perhae (1972) postulates that 90 to 99 percent of all lead is in the sediment complexes. Because the Big River is well buffered, free lead ions are at low concentrations in the water. However, suspended particles do remain in the streams and affect the water quality of the stream and the aquatic life forms (Gale et al. 1973).

Sediment concentrations of lead tends to be greatest in areas where water is deep and slow moving, and least in shallow or nearshore waters where water movements restrict the build-up of lead (Great Lakes Science Advisory Board). Within a lake, the average lead value for deep layers of an unpolluted lake sediment is 16 ppm and for the surface layers, 95 ppm (Nriagu 1978). At Clearwater Lake in Missouri, which is the recipient of most of the surface waters that drain the New Lead Belt, the lead concentration in the sediment ranges from 3 ppm to greater than 60 ppm. It was concluded that the lead concentrations were well within the limits of tolerance. However, the lake frequently floods, which is a contributing factor to the tolerant lead levels, because the increased flows have a diluting effect on the concentrations (Gale et al. 1976). In Lake Coeur d'Alene in Idaho, greater than 5,000 ppm have been estimated within the sediments. This ecosystem is being affected due to the deposition of mine wastes, which have caused extensive waterfowl mortality (Chupp and Dalke 1964). Typically, the sediments in a polluted river have been found to have an average lead value of 98 ppm (Nriagu 1978). Although the

lead is accumulated within the sediments, some leaching into the water occurs. Values as high as 2,900 ppm for sediments have been reported for the Big River (Schmitt and Finger 1982).

BIOLOGICAL EFFECTS

Fish and wildlife acquire the lead either by direct ingestion of the sediment, by obtaining the leached lead within the water, or by consumption of lead contaminated food. In several studies on lead in Great Lakes fish (Leland and McNurney 1974; Whittle 1980; Great Lakes Science Advisory Board), the smaller planktivores and omnivores with a high surface-to-body weight ratio had higher lead concentrations, which presumably allows for easier adsorption. Benthic (bottom) feeders are the primary organisms at risk. Herbivorous fish tend to develop higher concentrations of lead than carnivorous fish, perhaps due to a smaller size, diet composition, or feeding by sifting contaminated sediments (Leland and McNurney 1974). Because of the diet of herbivorous fish, they have a more direct link in obtaining lead (Great Lakes Science Advisory Board). In studying the concentration of lead in the Big River, Czarnecki (1985) found that suckers (Moxostoma spp., Hypentelium spp.), which are benthic feeders, had much higher levels of lead than the smallmouth bass (Micropterus dolomieu), which spends little time foraging on the stream bottom. The amount of lead in the suckers in 1980 posed such a hazard that the Missouri Division of Health, in conjunction with the Missouri Department of Conservation, recommended that suckers caught within 64 km (40 miles) downstream of the break in the Desloge tailings dam on Big River, not be eaten (Czarnecki 1985). Also, it should be noted that Czarnecki's study reflected lead levels from fillet samples, but lead concentrations in whole fish are much higher (Schmitt 1986), which is important because fish-eating wildlife consume the entire fish.

Not only are benthic fish acquiring lead through the lead-contaminated sediment, but those birds that sift the bottom of lakes and rivers in search of food are at risk as well. Most of the literature reviewed on birds that obtain lead by sifting, deal with the ingestion of lead shot; yet there is no reason to believe that lead from contaminated sediments would not be acquired by these birds in the same way. At Tule Lake in California, tundra swans (Cygnus columbianus) were believed to have acquired lead shot from the bottom of lakes and ponds enroute to their northern migration. Mortality losses of tundra swans were attributed to lead poisoning (Rosen and Bankowski 1960). Similarly, trumpeter swans (Cygnus buccinator) died of lead poisoning in western Canada as they fed, acquiring sand from lead contaminated sediment (Munro 1925). According to the Missouri's Fish and Wildlife Information System (Koeln and Ulrich 1984), many diving ducks inhabit the Big River including the ring-necked duck (Aythya collaris), common goldeneye (Bucephala clangula), redhead (Aythya americana), greater scaup (Aythya marila), and lesser scaup (Aythya affinis). These birds are probably at risk of acquiring lead from contaminated sediment as they search for food. The dabbling ducks such as the

American black duck (Anas rubripes), mallard (Anas platyrhynchos), American wigeon (Anas americana), and northern shoveler (Anas clypeata) also acquire lead by ingesting sediment in the process of feeding (Reid 1948; Trainer and Hunt 1965).

Another factor to consider is that some lead is leached into the water from the sediment. The suspended particulate matter containing lead has been shown to adsorb (adhere to the surface) to crayfish (Orconectes nais) and the foliage of macrophytes. Lead is also absorbed through the roots of these plants, but there is little vertical transport from the roots to the foliage; therefore, the lead that occurs on the foliage results from the desorption of lead ions into the water from the sediment and the subsequent adsorption onto the plant surface (Behan et al. 1979; Knowlton et al. 1982). Similarly, the leached lead adheres to the exoskeleton of the crayfish. Crayfish usually eat their old exoskeleton soon after molting; therefore, they ingest high concentrations of lead in their systems. While molting lessens the external concentration of lead, it increases the internal level. Crayfish feed primarily on worms, insects, and fish, and may acquire lead from these organisms. Lead that is absorbed directly through the gills has been shown to affect the respiration of the crayfish (Knowlton et al. 1982). The observation that crayfish and macrophytes obtained lead through adsorption of the lead from the sediment leaves open the possibility of other organisms contacting lead in this way as well. The suspended particles, containing lead, adhering to the surface of organisms and vegetation is therefore a threat to both predators and herbivores.

In all probability the greatest route of exposure is from ingestion of lead contaminated food. According to Niethammer et al. (1985), lead concentrations decrease with increasing trophic levels. The bottom feeding animals such as the crayfish, fish, and waterfowl that directly ingest the lead are at risk of contamination. Also, it remains a threat to those organisms that continually consume lead contaminated food. For example in southeastern Pennsylvania, muskrats (Ondatra zibethicus) were found to have high lead levels because they fed on cattails that had been exposed to lead (Erickson and Lindzey 1983).

Muskrats in Niethammer's study (1985) showed higher lead levels in the contaminated Big River ecosystem when compared to controls. Muskrats are chiefly vegetarian, but it has been found that muskrats in the Missouri Ozarks also feed on crayfish, fish, frogs, and reptiles (Schwartz and Schwartz 1981). Bullfrogs, water snakes, and crayfish, all from the Big River, have been reported to have high lead levels (Niethammer 1985). Although most consumers of crayfish do not digest the exoskeleton, the fact that the lead is merely adsorbed to the exoskeleton may allow for the lead to be absorbed (Knowlton et al. 1982).

Green-backed herons (Butorides striatus) were also shown to have high lead concentrations in Niethammer's study (1985) on the Big River (0.15 ppm to 1.47 ppm). These lead levels were nearly six times greater than the lead levels in green-backed herons from an

uncontaminated river. Herons and their allies are wading birds that feed on aquatic animal life in shallow water. Besides the green-backed heron, the Big River is habitat for the great blue heron (Ardea herodias), cattle egret (Bulbulcus ibis), great egret (Casmerodius albus), the snowy egret (Egretta thula), little blue heron (Egretta caerulea), and the American bittern (Botaurus lentiginosus) (Koeln and Urich 1984). The common loon (Podiceps auritus) also feeds on various invertebrates and risks contamination. The green-backed heron consumes crayfish, especially herons that live in riverine habitats, but fish constitute the main part of their diet.

Although there is little literature on other lead contaminated fish-eating birds, it is reasonable to assume that other species of birds are being affected by eating the lead contaminated fish. Other birds inhabiting the Big River include the belted kingfisher (Ceryle alcyon), hooded merganser (Lophodytes cucullatus), bald eagle (Haliaeetus leucocephalus), double-crested cormorant (Phalacrocorax auritus), and osprey (Pandion haliaetus), all primarily feeding on fish (Koeln and Urich 1984). These birds may also be contaminated.

According to Stendell (1980), bald eagles do not regurgitate castings regularly; thus, they retain the lead. The bald eagle is able to accumulate lead up to a certain point, but at this "threshold point" any additional lead contamination will result in cessation of eating and ultimately death (Pattee et al. 1981). According to Pattee et al. (1981), lead levels greater than 10 ppm in the liver of bald eagles and greater than 5 ppm in the kidney of bald eagles, are good indicators of acute exposure to lead. In waterfowl, the critical lead intake level is estimated to be between 6 and 8 ppm before death occurs (Coburn et al. 1951). Lead was confirmed to interfere with normal sexual development in Japanese quail (Morgan et al. 1975) and affected the fertility of mallards (Elder 1954).

In northern Idaho, lead that had accumulated on the vegetation due to mine wastes affected many birds that fed on these plants (Chupp and Dalke 1964). The birds that showed high levels of lead included the American coot (Fulica americana), wood duck (Aix sponsa), snow goose (Chen caerulescens), northern pintail (Anas acuta), and Canada goose (Branta canadensis). It was found that birds that were feeding on the dead, lead-contaminated waterfowl, were being affected in turn; these included the bald eagle, red-tailed hawk (Buteo jamaicensis), American crow (Corvus brachyrhynchos), herring gull (Larus argentatus), and ring-billed gull (Larus delawarensis). All of these birds occur in the Big River area.

Many animals and birds effected by lead die but are not found. Pheasants (Phasianus colchicus), quail (Callipepla spp.), and other gallinaceous birds are rarely found due to dense habitat, rapid decomposition, and scavenging animals (Westemeier 1966). Also, many birds may migrate from the area where they ingest lead, dying at different locations.

Young birds are affected at lower concentrations than adults due to their developing nervous system. In one-day old American kestrels (Falco sparverius), it was found that greater than 2 ppm lead in the liver or greater than 6 ppm lead in the kidney may be associated with growth impairment and greater than 5 ppm in the liver, 15 ppm in the kidney, or 2 ppm in the brain may be associated with impaired survival (Hoffman 1985). It is important to remember that lead accumulation in the soft tissues is greatest in the kidney and liver, yet the bones rapidly incorporate the lead and retain it for long periods of time. Therefore, over time, the build up of lead in the bones may have serious effects (Stendall 1980).

In addition to eating the lead-contaminated vegetation, animals may acquire lead through ingestion of the water which contains lead. Algal blooms, which are common in tailings ponds and streams near milling operations, trap particles of lead from the water. As the algae die or turbulent conditions arise, these trapped particles are transported downstream (Gale et al. 1976). It was also found by Niethammer et al. (1985), that bank swallows (Riparia riparia) show higher incidences of lead (2.0 ppm to 39 ppm) than rough-winged swallows (Stelgidopteryx serripennis) of the Big River area presumably because the bank swallows nest in the tailings. The rough-winged swallows nest in natural rock ledges. The bank swallows obtain the lead through adsorption, respiratory exposure, and direct ingestion from preening metal dust-laden feathers (Niethammer et al. 1985).

LEAD TRANSPORT THROUGH THE AIR

Also of concern in lead exposure is aerial transport of lead and subsequent deposition on vegetation, where it becomes accessible to wildlife. Aerial transport needs to be looked at closely. Lead is emitted into the air by smelters, through wind erosion from tailings, and through automobile emissions.

Lead smelters are one source of lead contaminated particulate matter (Wixson 1977), although not the major source. The major sources appear to be non-point sources, such as trucking or railroad operations (Wixson 1977). Automobiles are also responsible for large amounts of lead being emitted into the environment. Of the sixty percent of lead used in the auto industry, twenty percent is used in the production of tetraethyl lead for gasoline with seventy to eighty percent of that twenty percent being released into the environment. Although the trend has been to non-leaded gasoline, there has been a 50-year period in which lead has been used in gasoline. Roadside soil 1.5 meters (1.6 yards) away from a highway in Minnesota contained 245 ppm of lead, as compared to 75 ppm, 61 meters away (67 yards) (Alexander 1972). Lead is strongly adsorbed by soil and thus is a problem near roadsides. Plants that grow in this soil absorb the lead through their roots and there is some vertical transport; therefore, it may pose a problem for wildlife that feed on these

plants. It takes a large amount of lead concentration to pose a serious threat, but in combination with other metals, the effect is greater (Hassett et al. 1976). Lead uptake by plants is generally a function of the amount of lead in the soil.

Birds, most notably ground insectivores, are prone to accumulation of lead contamination from lead contaminated soil. In Virginia, rock doves (Columba livia) were shown to have acquired lead because they ingested grit from the roadside. Although the levels were not extremely high, the possibility of chronically lethal exposure remains (Kendall and Scanlon 1982a). Furthermore, urban birds were shown to have higher lead concentrations (12 ppm) than rural birds (2 ppm) but showed no apparent adverse effects from it (Kendall and Scanlon 1982b). In Maryland, highway birds were also shown to have a higher lead intake than rural birds, but again showed no signs of intoxication. Grue et al. (1984) state that ground feeding birds are subjected to higher concentrations of lead than aerial feeding birds.

CORRECTIVE MEASURES

After the rupture of the dam at Desloge in 1977, many agencies were involved in trying to deal with the problem. Concern was expressed, numerous recommendations and proposals were made, but groups such as the University of Missouri at Rolla, Department of Civil Engineering and the Missouri Department of Natural Resources, Missouri Geological Survey that had seriously planned on reconstructing the dam were unable to obtain the appropriate funds (George 1983).

Of the numerous recommendations that have been proposed in the past, the most popular one has been to vegetate the tailings. It has been found that the tailings will support a vegetative cover if fertilized and planted in grass, thus lessening wind and water erosion (George 1983; Schmitt 1985).

Two proposals included: 1) returning the tailings to the underground cavities from which they were taken and 2) chemically stabilizing the tailings so that a crust is formed (George 1983).

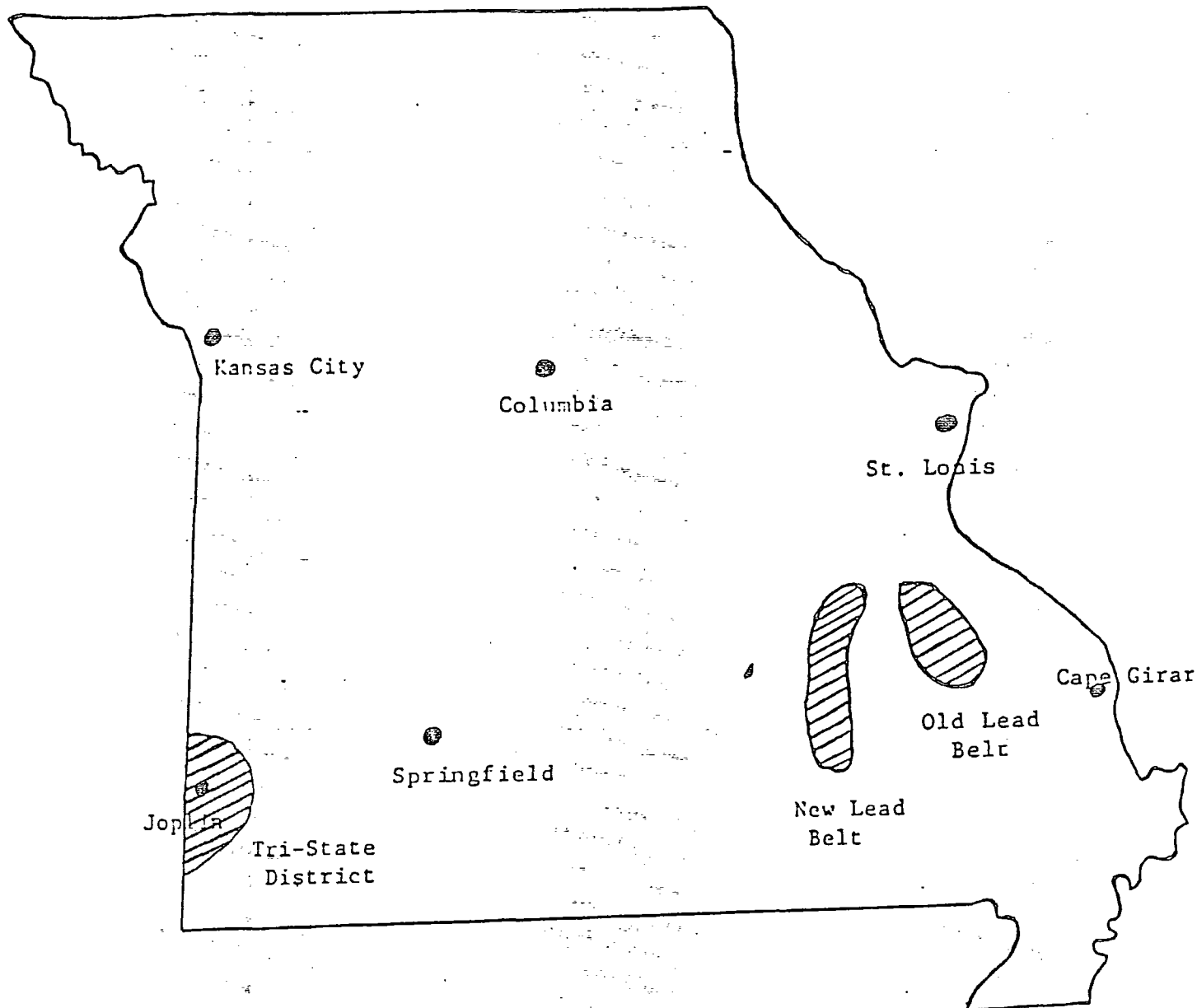
The Bureau of Mines, along with the St. Joe Mineral Company, had a project underway for vegetative stabilization, but the project was canceled as of July 1983, for unknown reasons (George 1983). In 1980, the Missouri Department of Natural Resources estimated that it would cost \$200,000 to control mine tailing discharges into the Big River from a 200 hectare (500 acres) tailing site (Novak and Hasselwander 1980). It is estimated that the Big River drainage alone contains 1,215 hectares (3,000 acres) of tailings.

APPENDIX

Rare and Endangered Bird Species of Missouri's Big River

E = endangered-Official Federal or State classification
R = rare-Official State classification

Scientific name	Common name	Status	
		U.S.	MO.
Accipitridae			
<u>Accipiter cooperii</u>	Cooper's hawk		E
<u>Accipiter striatus</u>	sharp-shinned hawk		E
<u>Buteo lineatus</u>	red-shouldered hawk		R
<u>Circus cyaneus</u>	northern harrier		E
<u>Ictinia mississippiensis</u>	Mississippi kite		R
<u>Haliaeetus leucocephalus</u>	bald eagle	E	E
<u>Pandion haliaetus</u>	osprey		E
Ardeidae			
<u>Botaurus lentiginosus</u>	American bittern		R
<u>Egretta caerulea</u>	little blue heron		R
<u>Egretta thula</u>	snowy egret		E
Falconidae			
<u>Falco peregrinus</u>	peregrine falcon	E	E
Phalacrocoracidae			
<u>Phalacrocorax auritus</u>	double-crested cormorant		E

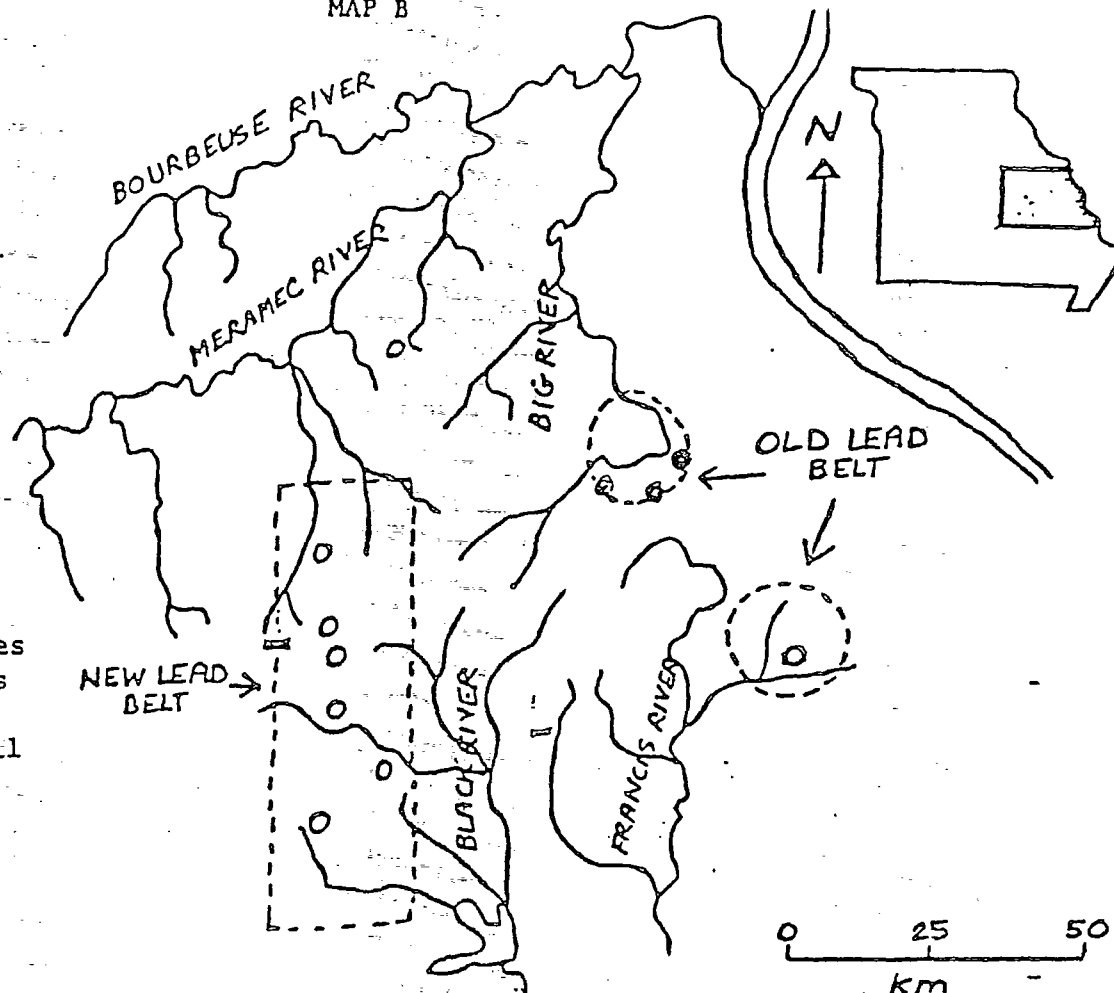


MAP B

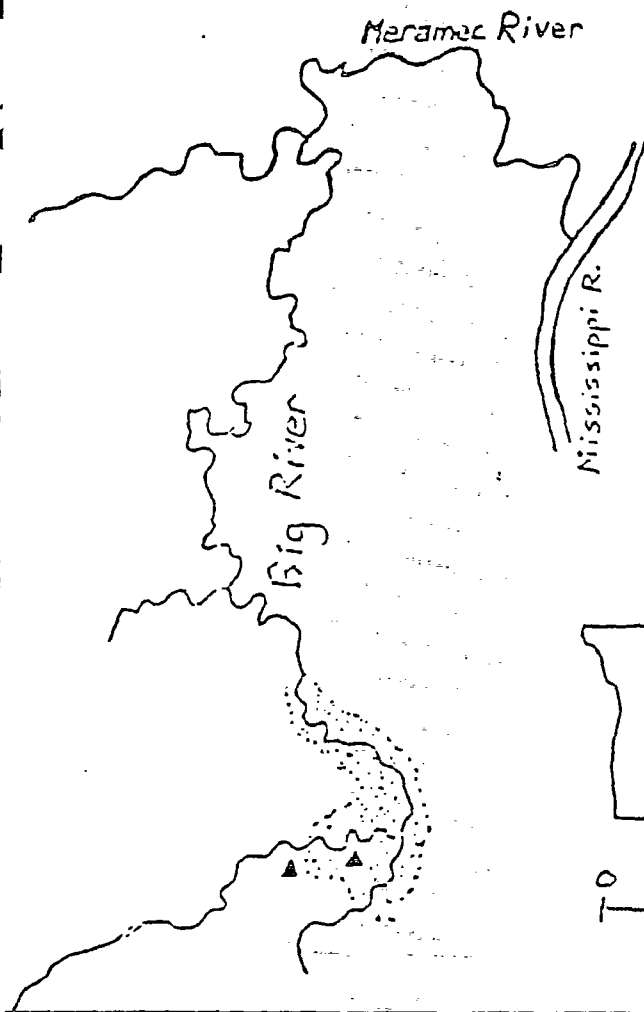
● Abandoned lead mines and settling basins

○ Active mine and mill facilities

■ Active smelters



(Taken from J.M. Czarnecki 1985 Accumulation of lead in fish from Missouri streams impacted by lead mining)



▲ Major source of mine tailings to Big River

● Sediments that are composed of tailings

(Taken from C.J. Schmitt et al. 1984 Bio-availability of lead and zinc from mine tailings as indicated by erythrocyte δ -aminolevulinic acid dehydratase activity)

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Adler, F.E.W. 1944. Chemical analyses of organs from lead-poisoned Canada geese. J. Wildl. Manage. 8:83-85.

In studies on 6 birds, the liver proved best for analysis and the bones for determining chronic poisoning. Included were 2 captives showing no current lesions but revealed prior exposure to lead-poisoning upon analysis. Pb varied from 0 to 192 ppm in different organs and specimens. — T.I. Storer.

Alexander, J.D. 1972. Lead in Illinois agriculture. Dept. of Agronomy, Univ. of Illinois. pp. 46-48.

Several samples of soil were taken at various locations around the state of Illinois from 1925 until 1972 to determine the lead content. In 1925, the overall average was 10 ppm and recent values were 25 ppm. It was determined that the lead content was highest in the surface soils of the northeast to southwest corridor of Illinois due to the heavy volume of traffic. — D.M. Kania.

Baumhardt, G.R. and L.F. Welch. 1972. Lead uptake and corn growth with soil-applied leads. J. Environ. Qual. 1:92-94.

Corn (*Zea mays* L.) was grown in the field where lead acetate had been soil-applied at 8 rates ranging from 0 to 3,200 kg/ha of lead. Emergence, plant height, and grain yield were not affected by added lead. Neither were any morphological, color, maturity, or other growth differences visually observed during the 2-year study. Added lead increased the lead content of stover. Lead content (ppm) of the stover for the 0 and 3,200 kg/ha treatments were: 2.4 and 37.8 for young whole plants, 3.6 and 27.6 for leaves at tasselling, and 4.2 and 20.4 for whole plants at grain harvest. Lead content of grain averaged 0.4 ppm lead and was not affected by added lead. — Authors' Abstract.

Besser, J.M. 1965. Bioavailability and toxicity of heavy metals in mine tailings leachate to aquatic invertebrates. M.S. Thesis, Univ. Mo.-Columbia.

Erosion and leaching of large deposits of lead mine tailings in the "Old Lead Belt" of southeast Missouri have led to extensive contamination of streams of the Big River drainage with toxic heavy metals. Although revegetation of the tailings piles to reduce erosion has been proposed, the effects of revegetation on the release of metals from the tailings have not been studied. In this study, aquatic invertebrates were exposed to leachates from test plots of tailings to evaluate the effects of cover materials on the bioavailability and toxicity of metals in tailings leachates.

Bioaccumulation of metals from test plot leachates was increased in tailings plots with cover treatments of vegetation (seed/fertilizer and sod treatments) or organic matter (sludge and leaf treatments), relative to uncovered tailings or uncontaminated crushed dolomite. Differences in metal bioaccumulation among treatments corresponded to dissolved metal concentrations in leachates, although invertebrates were apparently able to accumulate metals from ingested solids as well. Formation of complexes with dissolved organic compounds led to high metal concentrations in leachate from the leaf treatment, which showed the highest metal bioaccumulation.

Toxic effects of leachates on survivorship of crayfish and survivorship, growth, and development of midge larvae showed similar trends among cover material treatments. Toxicity of leachates was more strongly correlated with water metal concentrations than with accumulated metals, suggesting that not all accumulated metals exerted toxic action. Significant adverse effects on invertebrates occurred in this study at metal concentrations comparable to those measured in the Big River system and in seepage from tailings piles.

The benefits of revegetation of the large tailings piles in the Old Lead Belt probably outweigh the adverse effects of cover materials on leachate formation. However, the processes observed in this study probably also act on tailings already eroded into stream and riparian habitats, posing a long-term threat of metal toxicity to aquatic biota and human consumers of contaminated fish.
-- J.M. Besser.

Chupp, N.R. and P.D. Dalke. 1964. Waterfowl mortality in the Coeur d'Alene River Valley. J. Wildl. Manage. 28:692-702.

Waterfowl mortality in the Coeur d'Alene River Valley has aroused public concern since the early 1900's. An investigation and evaluation of the valley as waterfowl habitat was begun in 1954. Information from this and subsequent studies leaves little doubt that contamination of the Coeur d'Alene mining area is the prime cause of the bird losses. Analyses of numerous soil, plant, and waterfowl specimens collected in the valley showed abnormally high concentrations of lead, zinc, and copper. The toxic effects of the assimilated mine wastes, coupled with environmental stress in the winter and early spring, are apparently sufficient to produce the mortalities noted. Management considerations associated with alleviating the problem of bird losses in the Coeur d'Alene River Valley are discussed briefly. -- Authors' Abstract.

Coburn, D.R., D.W. Metzler, and R. Treichler. 1951. A study of absorption and retention of lead in wild waterfowl in relation to clinical evidence of lead poisoning. J. Wildl. Manage. 15:186-192.

The critical daily dosage level was found to be between 6 and 8 mg./kg. The avg. survival time for birds dosed at a level of 12 mg./kg. was 3.5 days less than for birds receiving lead at the 8 mg./kg. level, but there was no significant difference in the deposition of lead in the tissues of the 2 groups. Lead metabolism studies for 3 consecutive periods showed comparable rates of retention for the 2 dosage levels, with no significant difference in lead retention. The rate of deposition of lead in the tissues, as indicated by metabolism tests, was found to be such that related clinical symptoms could be predicted. Any one of 3 units, skeleton, liver, or soft tissues might be satisfactory as field samples for the detn. of lead poisoning by chemical analysis. -- J.B. DeWitt.

Cook, R.S. and D.O. Trainer. 1966. Experimental lead poisoning of Canada geese. J. Wildl. Manage. 30:1-8.

Canada geese (Branta canadensis) were experimentally exposed to known amounts of lead. The course of the lead and of the disease in geese was followed, utilizing established laboratory procedures. Gross signs of lead poisoning first appeared 5-7 days following ingestion. The length of time until signs of disease or death occurred was related to the amount of lead ingested. Twenty-five or more pellets resulted in death within 10 days, while 10 or fewer pellets permitted survival as long as 72 days. Ingestion of large numbers of pellets resulted in a rapid increase of lead levels in the blood, acute poisoning, and early death. Ingestion of fewer pellets resulted in a slower increase of lead in the blood, chronic poisoning, and longer survival, with more "typical" lead poisoning signs and pathology. Lead pellets appeared to erode at a constant rate regardless of the number in the gizzard. The largest lead pellet volume (66 percent) was eroded within the first 3 days after exposure, and it took approximately 45 days for the remaining volume to disappear. Normal lead levels of blood for Canada geese were found to be 0.018-0.037 mg/100 g blood. The lead levels of blood of lead-poisoned geese reached a peak between the third and tenth day, and ranged from 0.320-1.680 mg/100 g. Internal lesions as well as histopathological changes are described. High lead levels in blood and liver tissue, typical signs, and pathological lesions were necessary to diagnose lead poisoning in geese. The possible significance and effect of lead poisoning on the fecundity of geese are discussed. — Authors' Abstract.

Czarnecki, J.M. 1985. Accumulation of lead in fish from Missouri streams impacted by lead mining. Bull. Environ. Contam. Toxicol. 34:736-745.

Fish samples were taken from three areas impacted by lead mining: the Big River in the Old Lead Belt, streams in the New Lead Belt, and streams in the Tri-State Mining District. It was found that the Old Lead Belt area had the highest concentrations of lead in fish, with the golden redhorse having the highest (1.30 ppm). The World Health Organization's maximum safe level is 0.3 ppm in tissue for human consumption. Both the New Lead Belt and the Tri-State Mining District exhibited lower concentrations than the Big River area (highest concentration: 0.21 ppm and 0.49 ppm) and were not much different than the controls. -- D.M. Kania.

Davies, P.H. and W.H. Everhart. 1973. Effects of chemical variations in aquatic environments: Volume III, lead toxicity to rainbow trout and testing application factor concept. 80 pp.

Four chronic bioassays were conducted to determine the toxicity of lead to rainbow trout. Results obtained from acute and chronic bioassays in hard water (alkalinity 243.1 mg/liter) and soft water (alkalinity 26.4 mg/liter) were used to test the application factor approach as related to different water qualities. The toxicity of lead to rainbow trout in hard water was determined on a total and dissolved lead basis. The 96-hr TL₅₀ and "MATC" on a total lead basis were 471 mg/liter and 0.12 to 0.36 mg/liter respectively, which yielded an application factor of .0002 to .0008. Analysis of the free or dissolved lead gave a 96-hr TL₅₀ of 1.38 mg/liter and a "MATC" of 0.018 to 0.032 mg/liter, resulting in an application factor of .0130 to .0232. Total and free lead were considered to be the same in soft water. The 18-day TL₅₀ and "MATC" obtained from the soft water bioassays were 140 microgram/liter and 6.0 to 11.9 micrograms/liter lead respectively. Computations using the TL₅₀ and "MATC" values gave a soft water application factor of .0429 to .0850. The maximum acceptable toxicant concentration ("MATC") was determined in both hard and soft water bioassays on the occurrence of abnormal black tails caused by chronic lead exposure. The application factor approach as related to different water qualities was found to be very promising when lead analysis was limited to the free or dissolved metal and failed when total hard water lead concentrations were used. -- Authors' Abstract.

Elliott, L.E. 1982. Impacts of tailings from abandoned lead mines on the water quality and sediments of Flat River Creek and Big River in southeastern Missouri. M.S. Thesis, Univ. Mo. - Rolla.

Significant accumulations of century old lead mining wastes now exist as large tailings or chat piles in the Old Lead Belt of Southeastern Missouri. This material has been found to contribute to heavy metal contamination of the sediments of receiving streams in the area.

The National Tailings Pile was characterized for its heavy metal (Pb, Zn, Cd, and Cu) concentrations. Average values of each metal from the tailings pile and from severe erosion areas on the north and east sides of the pile were determined. For the main pile, lead averaged 3508 ppm, zinc 457 ppm, cadmium 7.2 ppm, and copper 183 ppm. The averages found in the north erosion area were: lead 2510 ppm, zinc 112 ppm, cadmium 4.9 ppm, and copper 61 ppm. In the east erosion area, these metals were found to average: lead 6894 ppm, zinc 295 ppm, cadmium 6.4 ppm, and copper 196 ppm.

Material from the National Tailings Pile was found to have been carried into Flat River Creek, and subsequently Big River, to become part of the stream sediment. Peak values for each of the metals in the sediment material downstream of the pile were: lead 7221 ppm, zinc 4875 ppm, cadmium 89 ppm, and copper 356 ppm.

The water quality parameters of Flat River Creek and Big River examined were: turbidity, pH, total alkalinity, total hardness, total and dissolved solids, total lead, zinc, cadmium, and copper, dissolved oxygen, and chemical oxygen demand. It was found that runoff from the National Tailings Pile posed no obvious detrimental impact under low flow conditions in regard to these water quality parameters. -- L.E. Elliott.

Erickson, D.W. and J.S. Lindzey. 1983. Lead and cadmium in muskrat and cattail tissues. J. Wildl. Manage. 47:550-555.

A study in southeastern Pennsylvania was conducted to determine the concentrations of lead and cadmium in cattails, since they are an important food source for muskrats; and the relation to levels in muskrat livers and kidneys. Rootstocks were found to contain higher concentrations of lead than the foliage and stems. Cadmium concentrations varied considerably. It was concluded that lead in muskrats varies in relation to prevailing environmental exposure. Cadmium relationships were not apparent. Also, it was found that females contained higher levels of cadmium than males. It was pointed out that other factors also influence the concentrations.
— D.M. Kania.

Gale, N.L., E. Bolter, and B.G. Wixson. 1976. Investigation of Clearwater Lake as a potential sink for heavy metals from lead mining in southeastern Missouri. In: D. Hemphill (ed.) Proc. 10th Ann. Conf. on Trace Substances in Environ. Health, Univ. of Mo.-Columbia, p. 187.

The geomorphology of Southeast Missouri makes Clearwater Lake near Piedmont the recipient of most of the surface waters draining the Viburnum Trend, the world's largest lead mining district. One major research concern has been the possible accumulation of heavy metals in this lake from the combined drainage. Conventional dredging methods as well as hand collection devices used by research scuba divers were employed to collect sediment samples. These, together with selected samples of aquatic biota, were analyzed to evaluate the extent of trace metal accumulation after approximately 8 years of mining operation. Release of heavy metals from the mining district occurs primarily in the form of metal-rich solids from mine tailings and runoff from soils contaminated by mining and smelting activities.

Heavy metals may also be transported in dissolved form. Possible mechanisms of dissolution, exchange and eventual transport of heavy metals from industrial sources are strongly influenced by humic acids from detritus and other organic constituents of living components of the environment. This biological activity will increase the dissolution of heavy metals solids, and also affect the geochemical mobility of metals through complexing and chelation.

In Clearwater Lake, lead concentrations in sediment ranged from less than 3 ppm at the points of stream entry to concentrations in excess of 60 ppm in deep quiescent water adjacent to the dam. Zinc and copper concentrations followed a similar trend, ranging from 10-84 ppm and 5-30 ppm respectively. Cadmium concentrations reached detectable levels (0.3 -0.5 ppm) only in samples collected near the dam.

Total body Pb content of bluegills, bass, goggle-eyes, catfish, and minnows collected in the lake ranged from undetectable levels to 14 ppm. The mucous membranes of skin and gills showed a particular affinity for heavy metals. Forage lead concentration in skin and scales ranged from undetectable levels in catfish to 21 ppm in bluegills. Gills from a variety of fish demonstrated Pb content of 5 - 18 ppm. Catfish gills were generally found to contain less Pb than those of bluegills. Freshwater mussels had total body Pb concentrations of 25-30 ppm, most of which was located in the shells. Soft internal tissues (muscle, heart, kidneys, gastrointestinal organs, and

reproductive organs) did not have detectable quantities. These data allow some interesting comparisons with similar data collected from areas of much higher heavy metal concentrations in the mining district. -- Authors' Abstract.

Gale, N.L., B.G. Wixson, M.G. Hardie, and J.C. Jennett. 1973. Aquatic organisms and heavy metals in Missouri's New Lead Belt. Water Resources Bulletin. 9:673-688.

The New Lead Belt of southeastern Missouri has recently become the largest lead producing region of the world. The impact of this rapid development on the previously rural and undeveloped region of the Missouri Ozarks is the subject of a continuing interdisciplinary study. Since the industrial development began, there have been a number of nuisance biological blooms in several of the small streams receiving effluent from the mines and mills. The major constituents of the problem algal growths were identified and found to include: Cladophora, Oscillatoria, Mougeotia, Zygnema, Spirogyra, Cymbella, and a variety of other stalked and non-stalked diatoms. Secondary blooms of Sphaerotilus were observed to reach problem proportions in some streams, particularly in the autumn. Finely ground rock flour and mineral particles escaping from tailings dams were found to be trapped by the stream vegetation. Concentrations of lead, zinc, copper, and manganese in the algal and bacterial mats were found to be inversely related to distance downstream from the tailings dams. Consumer organisms, including crayfish, snails, aquatic insects, tadpoles, minnows, and larger sunfish were analyzed to determine the extent of dissemination and concentration of the heavy metals through food chains. Preliminary results indicated significant concentrations of heavy metals in those consumer organisms studied, though in at least one problem stream the normal consumer organisms mentioned were markedly reduced in numbers. (KEY TERMS: New Lead Belt; Missouri; heavy metals; food chains; algal and bacterial mats). - Authors' Abstract.

George, L.C. 1983. Bureau of Mines, Overview Status Report. 4 pp.

Due to the rupture of a dam at Desloge, Missouri, and the subsequent washout of tailings into the Big River, many agencies got involved. Many proposals were recommended by various agencies, but either they did not get off the ground or the appropriate funding was not available. However, the Bureau of Mines, with the cooperation of other agencies, did a study on the tailings in 1981. Recommendations included vegetating the tailings to stabilize them, utilizing the tailings as construction material, and removing the tailings. Although the waters

of the Big River are well within the established drinking water limits, the lead contamination is adversely affecting benthic fish. Vegetative stabilization was planned in 1981, but was cancelled. -- D. M. Kania.

Great Lakes Science Advisory Board. Report of the Aquatic Ecosystem Objectives Committee on Lead. (Unpublished) pp. 63-102.

Anthropogenic lead enters the Great Lakes via air and water, primarily as a result of its use in gasoline. Inorganic lead concentrations in excess of 1,000 - 10,000 micrograms/L quickly react with complexing materials in lake water and precipitate to the sediments. Particulate lead is not available to predatory fish through uptake across the gills, but there are data to suggest it is available to filter-feeding zooplankton, herbivorous fish, and fish that sift bottom mud for food organisms. Non-complexed lead at concentrations <1,000 micrograms/L is readily taken up by aquatic biota; however, since it is also available for adsorption to particulates, it should quickly disappear. Consequently, aquatic biota should be exposed to significant concentrations of non-complexed lead only near mixing zones of municipal and industrial effluents and river mouths. Bottom-feeding and herbivorous fish and filter-feeding zooplankton would also receive significant exposures anywhere that lead-contaminated particulates or sediments drift. The continual movement of fine-grained sediments in the Great Lakes will therefore cause widespread low-level contamination of these organisms. Further lead contamination may be caused by biological and chemical methylation processes in sediments; alkyl lead compounds have been observed in Great Lakes fishes. Other sources of organic lead in fish could be industrial wastes and spillage and evaporation of leaded gasoline. The lipophilic organo-lead compounds will behave differently from inorganic lead and will tend to accumulate easily and quickly in biological tissues.

Impacts of lead will be associated with point sources where aquatic biota respond to free lead in water, and in areas where contaminated sediments settle. The overall impact on aquatic biota is difficult to assess, but it will probably be greatest in long-lived organisms that are non-migratory and live near high-level point sources, since they will acquire a high lifetime exposure. Sensitive zooplankton and phytoplankton may be severely affected by drift through mixing zones, but presumably large population sizes would allow recolonization of affected water as it mixes with clean water. Adverse impacts are best documented for wildfowl populations that exhibit high mortality rates due to ingestion of spent lead shot. Lead contamination of

However, there may be unknown instances of inshore intakes. Inorganic lead contamination of fish as human food seem to be a problem, since these data are generally or in fish exposed to high inorganic lead levels. However, these guidelines previously are under review.

Grue, C.E., T.J. O'Shea, and D.J. Hoffman. Lead concentrations in highway-nesting birds. *Environmental Science and Technology* 19: 105-108, 1985.

Lead concentrations in the carcasses and stomach contents of adult and nestling Barn Swallows (*Hirundo*) collected within the right-of-way of a highway-nestling barn swallows. Condor. 86:383-389. and D.J. Hoffman. 1984. Lead exposure and concentrations in recently withdrawn and collected within the right-of-way of a highway-nestling barn swallows. Condor. 86:383-389.

greater than those of rural adults, but concentrations in the latter at 16-18 days of age were similar. Activity of nestlings from the highway colonies, as were body weights of adults, was lower in highway-nesting adults and counterparts, although the number of delta-aminolevulinic acid dehydratase results suggest of similar weights of adults from roadside habitat by lead from authors' Abstract.

Abstract. Capacity of selected Illinois Comm. in Soil Science of the two results in the two from automotive contamination of the two birds that are aerial feeders.

ing added to the environment in automotive
as an industrial pollutant. To understand its
environment, it is necessary that factors
capacity of soils to sorb Pb be determined.
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is necessary to sorb Pb from aqueous solutions was
analysis indicated the capacity of soil
increasing C.E.C., pH and column leaching
surface P level.
on Pb sorption than soil pH,
eater effect than soluble P.

Hassett, J.J. 1976. Determination of lead sorption capacities of selected Illinois soils using titration curves. Comm. in Soil Science and Plant Analysis. 7:189-195.

The capacity of a soil to sorb or bind Pb^{+2} may be determined by titrating the soil with a $PbCl_2$ solution. The addition of Pb to the soil results in a shift in pH. The sorption capacity corresponds to the point of maximum curvature in the titration curve. Sorption capacities obtained in this manner are highly correlated with plant uptake. -- J.J. Hassett.

Hassett, J.J. and J.E. Miller. 1977. Uptake of lead by corn from roadside soil samples. Comm. in Soil Science and Plant Analysis. 8:49-55.

The uptake of Pb by young, greenhouse grown corn plants from roadside soil was found to be not only dependent upon the total amount of Pb in the soil, but also upon the amount of Pb in the soil relative to the soils capacity to sorb Pb. This is in agreement with the uptake of Pb by corn grown on soils amended with $PbCl_2$, although plant accumulation of Pb from roadside soils was much less than from $PbCl_2$ amended soils at comparable Pb concentrations. The use of crushed limestone as a road building material which results in high soil pH values next to the roadside is probably responsible for the reduced plant availability of Pb in the roadside soils. -- Authors' Abstract.

Hassett, J.J., J.E. Miller, and D.E. Koeppe. 1976. Interaction of lead and cadmium on maize root growth and uptake of lead and cadmium by roots. Environ. Pollut. 11:297-302.

Radicle elongation of soil-grown maize seedlings was depressed by concentrations of 25 micrograms Cd/g of soil or 250 micrograms Pb/g of soil when the metals were added singly. When Pb and Cd were added in combination inhibition of radicle elongation occurred at significantly lower concentrations. The effect of the metals when added in combination was greater than the sum of effects when the metals were added singly, thus strongly suggesting a synergistic interaction. The effect was partially attributed to elevated accumulation of the metals in combination treatments. -- Authors' Abstract.

Hoffman, D.J., J.C. Franson, O.H. Pattee, C.M. Bunck, and A. Anderson. 1985. Survival, growth, and accumulation of ingested lead in nestling American kestrels (Falco sparverius). Arch. Environ. Contam. Toxicol. 14:89-94.

One-day old American Kestrel (Falco sparverius) nestlings were dosed orally daily with 5 micrograms/L of corn oil (controls), 25 mg/kg, 125 mg/kg, or 625 mg/kg of metallic lead in corn oil through day 10. Forty percent of the nestlings given 625 mg/kg died after six days. Growth rates became significantly different from controls in the

625 mg/kg group by day 3 and in the 125 mg/kg group by day 4. Crown-rump lengths and brain weights were significantly lower in both treatment groups. Liver and kidney weights were lower in the 625 mg/kg groups. Skeletal examination and measurement of alizarin red-S stained nestlings revealed reduced growth for the humerus, radius-ulna, femur, and tibiotarsus in the 125 mg/kg and 625 mg/kg groups. Skeletons were otherwise normal in appearance. Greater than 2 ppm (wet weight) lead in the liver or 6 ppm in the kidney was associated with suppressed growth, while more than 5 ppm in the liver and 15 ppm in the kidney occurred in survivors in the 625 mg/kg group. The order of accumulation of lead in tissues at the end of 10 days was kidney > liver > brain. These findings suggest that altricial nestlings may be considerably more sensitive to lead exposure than adults and also more sensitive than hatchlings of many precocial species. — Authors' Abstract.

Kendall, R.J. and P.F. Scanlon. 1982a. Tissue lead concentrations and blood characteristics of rock doves from an urban setting in Virginia. Arch. Environ. Contam. Toxicol. 11:265-268.

Rock doves (Columba livia) live-trapped in Blacksburg, Va. had the following blood characteristics measured: Delta-aminolevulinic acid dehydratase (ALAD) activity, packed cell volume (PCV), and hemoglobin (Hb). Lead concentrations were measured in livers and femurs. Concentrations of lead in femurs were indicative of chronic exposure to lead in many individuals. A linear relationship was noted between ALAD activity and liver lead concentrations with ALAD decreasing with increased lead concentrations. — Authors' Abstract.

Kendall, R.J. and P.F. Scanlon. 1982b. Tissue lead concentrations and blood characteristics of mourning doves from southwestern Virginia. Arch. Environ. Contam. Toxicol. 11:269-272.

Studies were conducted on the feasibility of sampling the blood from live mourning doves (Zenaida macroura) as a technique for evaluating lead exposure in this species. Measurements of the blood enzyme, delta-aminolevulinic acid dehydratase (ALAD), were essentially the same in blood from the brachial vein or trunk blood. The ALAD activity decreased as liver lead concentration increased in mourning doves. Mourning doves that ingested lead shot had elevated lead concentrations in their femur bones and livers as compared to other doves which had not recently ingested lead shot. — Authors' Abstract.

Knowlton, M.F., T.P. Boyle, and J.R. Jones. 1982. Uptake of lead from aquatic sediment by submersed macrophytes and crayfish. Arch. Environ. Contam. Toxicol. 12:535-541.

Uptake of lead (Pb) by submersed aquatic macrophytes and crayfish exposed to artificially contaminated pond sediment was measured under laboratory conditions. Macrophytes accumulated Pb in root tissue and foliage. Internal transport of Pb by plants was not detected. Senescent macrophytes accumulated more than live plants. Crayfish exposed to contaminated sediment accumulated Pb principally through adsorption to the exoskeleton and lost Pb through molting, although internal uptake and elimination without molting was measurable. Exposure to Pb leached from sediment, surface to weight ratios, and frequency of molting seem to influence Pb uptake by crayfish. — Authors' Abstract.

Lu, P.Y., R.L. Metcalf, R. Furman, R. Vogel, J. Hassett. 1975. Model ecosystem studies of lead and cadmium and of urban sewage sludge containing these elements. J. Environ. Qual. 4:505-509.

The environmental fate and effects of cadmium and lead were studied in a laboratory model ecosystem with a terrestrial/aquatic interface, using silica sand, Bloomfield soil (sandy loam), and Drummer soil (silty clay loam) as substrates. Applications were made directly to the substrates as lead and cadmium chloride and as sewage sludge as a source of heavy metals. The mobilization and incorporation of cadmium and lead into food chain organisms were proportional to sorption capacity of the substrate and were highest in silica sand and lowest in Drummer soil. Following the application of sewage sludge there was clear cut mobilization and transfer of cadmium, copper, lead, and zinc into food chains, algae (Oedogonium cardiacum), daphnia (Daphnia magna), mosquito larva (Culex pipiens quinquefasciatus), snail (Physa), and fish (Gambusia affinis). Cadmium exerted a particularly adverse affect on the various organisms in the model ecosystem and its presence in relatively high levels in sewage sludge could become a limiting factor in its use on soils and for crop production. -- Authors' Abstract.

Miller, J.E., J.J. Hassett, and D.E. Koeppe. 1977. Interactions of lead and cadmium on metal uptake and growth of corn-plants. J. Environ. Qual. 6:18-20.

Short term plant accumulation and growth effects of Pb and Cd added to soil separately and in combination were investigated with corn (Zea mays L., Wf9 X M14) grown in a loamy sand under greenhouse conditions. A tendency for soil Pb to increase both the plant Cd concentration and the total Cd uptake of the corn shoots was observed. Conversely, soil Cd reduced the total Pb uptake and in some

cases the Pb concentration in the corn shoots. Both Pb (125 and 250 micrograms/g soil) and Cd (2.5 and 5 micrograms/g soil) reduced the vegetative growth of the corn shoots, and a positive interaction of the two metals on growth was noted. — Authors' Abstract.

Moore, J.W. and S. Ramamoorthy. 1979. Heavy metals in natural waters. Chapter 6. Lead. pp. 100-124.

Chapter six of this book deals with lead. Lead has been used mainly in storage batteries, metal products, chemicals, pigments, and various other products. Discharges of lead include emissions into the atmosphere, either naturally as in wind-blown dust, or through automobile exhaust and metal production. Lead in aquatic systems either binds to inorganic and organic ligands and/or particulates, and is easily transported through natural waters. Sediment accumulation is correlated to organic content and grain size. Greater than 500 ppm lead have been produced from the discharge of liquid mine wastes. High residue concentrations are also common for attached plants inhabiting polluted waters. Good bio-monitors of contamination include freshwater species of Elodea, Cladophora, and Myriophyllum. Also, invertebrates and fish are prone to lead contamination. Humans are susceptible to lead through the respiratory tract, with urban airborne particulates representing the major source. -- D.M. Kania.

Morgan, G.W., F.W. Edens, P. Thaxton, and C.R. Parkhurst. 1975. Toxicity of dietary lead in Japanese quail. Poultry Science. 54:1636-1642.

The toxicity of dietary lead in Japanese quail was investigated. The data indicated that dietary lead, in the form of lead acetate, was toxic to young quail at the level of 500 ppm and this toxicity was evidenced by an inhibition of normal growth and by anemia. The anemic state in the lead toxic quail was more readily detected by reduced blood hemoglobin concentrations than by packed cell volumes. In addition, the data suggested that lead interfered with normal sexual development in the males. Lead at levels as high as 1000 ppm did not prevent normal primary antibody responses to sheep erythrocytes. -- Authors' Abstract.

Niethammer, K.R., R.D. Atkinson, T.S. Baskett, and F.B. Samson. 1985. Metals in riparian wildlife of the lead mining district of southeastern Missouri. Arch. Environ. Contam. Toxicol. 14:213-223.

Five species of riparian vertebrates (425 individuals) primarily representing upper trophic levels were collected from the Big River and Black River drainages in two lead mining districts of southeastern Missouri, 1981-82. Big River is subject to metal pollution via erosion and seepage from large tailings piles from inactive lead mines. Black

River drains part of a currently mined area. Bullfrogs (Rana catesbeiana), muskrats (Ondatra zibethicus), and green-backed herons (Butorides striatus) collected downstream from the source of metal contamination to Big River had significantly (ANOVA, $P < 0.05$) higher lead and cadmium levels than specimens collected at either an uncontaminated upstream site or on Black River. Northern water snakes (Nerodia sipedon) had elevated lead levels below the tailings source, but did not seem to accumulate cadmium. Levels of lead, cadmium, or zinc in northern rough-winged swallows (Stelgidopteryx serripennis) were not related to collecting locality. Carcasses of ten bank swallows (Riparia riparia) collected from a colony nesting in a tailings pile along the Big River had lead concentrations of 2.0-39 ppm wet weight. Differences between zinc concentrations in vertebrates collected from contaminated and uncontaminated sites were less apparent than differences in lead and cadmium. There was little relationship between metal concentrations in the animals studied and their trophic levels. Bullfrogs are the most promising species examined for monitoring environmental levels of lead, cadmium, and zinc. Downstream from the source of tailings, bullfrogs had markedly higher levels of these metals in most of their tissues. The species is also widely distributed in North America, easily caught, and relatively sedentary. — Authors' Abstract.

Niethammer, K.R., M.S. Kaiser, R.D. Atkinson, and T.S. Baskett. 1983. Foods of the green-backed heron in the eastern Missouri Ozarks. Biological Sciences. pp. 117-127.

Analysis of upper digestive tracts of 107 green-backed herons (Butorides striatus) collected between 15 May 1981 and 15 September 1982 in the eastern Missouri Ozarks provided information on foods of this species in riverine and lacustrine habitats. Immature green-backed herons took more invertebrates (crayfish and insects), fewer fishes and smaller fishes than adult males, whereas the diet of adult females was intermediate. For example, fishes made up 70, 78, and 93% of diets of immatures, adult females and adult males, respectively, based on weight of prey. Insects and crustaceans constituted 28, 13, and 6%, respectively, of diets of immatures, adult females and adult males. A comparison of our data derived from digestive tracts with those obtained from an observational study in similar habitats of the same region indicated that observational studies may underestimate the number of small prey (e.g., insects) in the diet. Key Words: Green-backed heron, food habits, Missouri. -- Authors' Abstract.

Nriagu, J.O. (ed.) 1978. The biogeochemistry of lead in the environment, Part A. Elsevier/North Holland, N.Y., pp. 54-63.

Chapter 2 of this book concentrates on lead in sediments, both lake sediments and river sediments. The average lead content of an unpolluted lake sediment has been estimated at 16 ppm. The accumulation of lead comes from such sources as inputs from stream sediments and waters, groundwater, erosion of lake banks, fallout of windborne materials, and discharges of industrial and domestic effluents. The average lead value for riverine sediments with pollution is estimated to be 98 ppm. The concentration of lead in various soils, such as cosmos, meteorites and lunar samples, and major rock types is also dealt with in this chapter. — D.M. Kania.

Schmitt, C.J. 1985. Chemical characterization and biological activity of metals in leachates from lead mine tailings. U.S. Fish and Wildlife Service, Columbia National Fisheries Research Laboratory, Columbia, Missouri.

Raised bed test plots containing 15 - 20 cm of mine tailings from the old Lead Belt in southeastern Missouri were used in studying the effects of cover materials on leaching of Pb, Cd, Zn, and other chemical constituents from the tailings. The following cover materials, chosen to simulate the effects of vegetative stabilization of tailings piles, were studied: anaerobically digested sewage sludge ("S"), silver maple leaves ("L"), sod ("G"), fertilizer/seed mixture ("F"), and untreated ("U"). The plots were situated outdoors, and the rainfall leachates collected in vinyl receiving pools.

Comparison of filtrable metal concentrations in leachates utilized the Bonferroni multiple comparison method ($p < 0.05$) applied to ranked data. The following effects were observed during the first study season: $Pb - L > U > F$; $Cd - S - L > U$; $Zn - S > U > F$. During the second season, leaching of Pb and Zn from the leaf covered plot was greater than from the control plot.

Concentrations of Pb, Cd, Zn, and other metals were much lower in the receiving pool waters than in the initial leachates. Column studies showed the effects of the leaf and fertilizer treatments to be greatly reduced by percolation of the leachate through deeper layers of tailings.

Modeling of the data using the REDEQL.EPAK computer program indicated that the leachates were supersaturated with respect to HCO_3 , $CaCO_3$, and $ZnSiO_3$. Pb was predicted to be present primarily as $PbCO_3$ ion pair. Significant concentrations of "free" (aquated) Cd and Zn were predicted.

Filterable portions of Pb, Cd, and Zn were found to be completely dialyzable in non-turbid effluent samples, while non-dialyzable filtrable Pb was present in turbid effluent samples. Significant non-dialyzable fractions of all three ions were found in the filtrable portions of receiving pool waters.

Chelex-100 non-labile fractions of Pb were found present in leaf covered plot effluent and receiving pool water samples. Non-dialyzable species in these leachates were found to concentrate considerable amounts of Pb. Experiments with XAD 2 resin indicated these species to be non-polar. — C.J. Schmitt.

Schmitt, C.J., F.J. Dwyer, and S.E. Finger. 1984. Bioavailability of Pb and Zn from mine tailings as indicated by erythrocyte delta-aminolevulinic acid dehydratase (ALA-D) activity in suckers (Pisces: Catostomidae). Can. J. Fish. Aquat. Sci. 41:1030-1040.

The activity of the erythrocyte enzyme delta-aminolevulinic acid dehydratase (ALA-D) was measured in 35 catostomids (black redhorse, Moxostoma duquesnei; golden redhorse, M. erythrum; northern hogsucker, Hypentelium nigricans) collected from three sites on a stream contaminated with Pb-, Cd-, and Zn-rich mine tailings and from an uncontaminated site upstream. Enzyme activity was expressed in terms of hemoglobin (Hb), DNA, and protein concentrations; these variables can be determined in the laboratory on once-frozen blood samples. Concentrations of Pb and Zn in blood and of Pb in edible tissues were significantly higher, and ALA-D activity was significantly lower, at all three contaminated sites than upstream. At the most contaminated site, ALA-D activity was 62-67% lower than upstream. Lead concentrations in the edible tissues and in blood were positively correlated ($r = 0.80$), whereas ALA-D activity was negatively correlated with Pb in blood ($r = -0.70$) and in edible tissues ($r = -0.59$). Five statistically significant relations between Pb and Zn in blood and ALA-D activity were determined. The two models that explained the highest percentage (>74%) of the total variance also included factors related to Hb concentration. All five significant models included negative coefficients for variables that represented Pb in blood and positive coefficients for Zn in blood. The ALA-D assay with results standardized to Hb concentration represents an expedient alternative to the more traditional hematocrit standardization, and the measurement of ALA-D activity by this method can be used to document exposure of fish to environmental Pb. — Authors' Abstract.

Schmitt, C.J. and S.E. Finger. 1982. The dynamics of metals from past and present mining activities in the Big and Black River watersheds, south-eastern Missouri. Report to the U.S. Army Corps of Engineers, St. Louis District. U.S. Fish and Wildlife Service, Columbia National Fisheries Research Laboratory, Columbia, Missouri. 153 pp.

Lead, cadmium, and zinc were found in elevated levels in all forms examined in this study: algae, rooted plants, crayfish, mussels, and fish; so that the authors have no doubt as to the bioavailability of lead in the mining area of the Old Lead Belt. It was found that lead from the tailings is transported in the solid phase, and concentrations in the suspended load increase with water flow. Only barium appeared to be transported in a liquid phase to any extent. Both lead and cadmium were found to remain in an available form. Concentrations of metals in Clearwater Lake were all low levels and posed no serious threat. However, the downstream sections of the Big River showed the highest quantities of trace metals, with those accumulations in fish exceeding the recommended levels for human consumption. -- D.M. Kania.

Schmitt, C.J., S.E. Finger, T.W. May, and M.S. Kaiser. 1984. The availability of particulate lead and cadmium from mine tailings to the pocketbook mussel. Annual winter meeting, American Society of Limnology and Oceanography and American Geophysical Union, San Francisco, California. December 6.

The Big River, a hard-water stream in southeastern Missouri, has been heavily contaminated by mine tailing rich in Pb and Cd. We measured concentrations and estimated the availability of Pb and Cd in tailings and in streambed sediments from one site above (11 km) and two below (0.5 and 93 km) a source of tailings to the stream by collecting them in five fractions: exchangeable, carbonate-bound, oxide-bound, organic-bound, and residual. Pb and Cd concentrations were also measured every 2 wk for 8 wk in pocketbook mussels collected from an uncontaminated stream and caged at the three Big River sites.

Both Pb and Cd originally occurred as insoluble sulfides; nevertheless, relatively little Pb remained in the residual fraction, even in tailings and 0.5 km downstream. Conversely, > 50% of both Pb and Cd occurred in the carbonate-bound and oxide-bound fractions. Relatively small percentages of Pb and Cd were found in the exchangeable and organic-bound fractions at all sites. Mussels at both contaminated sites rapidly accumulated Pb and Cd in their soft tissues; those placed upstream did not. Examination of the gut contents of indigenous pocketbook mussels from the Big River revealed a much finer particle-size distribution than that of surficial stream sediments at capture sites. Correlation and regression

analyses were used to investigate the relations between particle size distributions, relative extractability of Pb and Cd from sediments, and the observed uptake of Pb and Cd by mussels. -- Authors' Abstract.

Spruill, T.B. 1985. Assessment of water resources in lead-zinc mined areas in Cherokee County, Kansas, and adjacent areas. U.S. Geological Survey. Open-file report. pp. 84-439.

A study was conducted to evaluate water-resources problems related to abandoned lead and zinc mines in Cherokee County, Kansas, and adjacent areas in Missouri and Oklahoma. Past mining activities have caused changes in the hydrogeology of the area. Lead and zinc mining has caused discontinuities and perforations in the confining shale west of the Pennsylvanian-Mississippian geologic contact (referred to as the western area), which have created artificial ground-water recharge and discharge areas. Recharge to the shallow aquifer (rocks of Mississippian age) through collapses, shafts, and drill holes in the shales has caused the formation of a ground-water "mound" in the vicinity of the Picher Field in Kansas and Oklahoma. Discharge of mine-contaminated ground water to Tar Creek occurs in Oklahoma from drill holes and shafts where the potentiometric surface of the shallow aquifer is above the land surface. Mining of ore in the shallow aquifer has resulted in extensive fracturing and removal of material, which has created highly transmissive zones and voids and increased ground-water storage properties of the aquifer. In the area east of the Pennsylvanian-Mississippian geologic contact (referred to as the eastern area), fractured rock and tailings on the land surface increased the amount of water available for infiltration to the shallow aquifer; in the western area, tailings on the impermeable shale created artificial, perched aquifer systems that slowly drain to surface streams.

Pumping of the deep aquifer (rocks of Cambrian and Ordovician age) by towns and industries, which developed as a result of the mining industry, has resulted in a potential for downward movement of water from the shallow aquifer. The potential is greatest in Ottawa County, Oklahoma. Because of the large volume of water that may be transported from the shallow to the deep aquifer, open drill holes or casings present the greatest contamination hazard to water supplies in the deep aquifer.

Mining allowed oxidation of ore deposits which, on saturation with water, resulted in poor-quality water that generally contains large concentrations of sulfate and trace metals. Water from mines in the eastern area contained dissolved-solids concentrations of less than 500.

mg/L (milligrams per liter), a median pH of 3.9, sulfate concentrations that ranged between 98 and 290 mg/L, and median concentrations for zinc of 37,600 micrograms/L (micrograms per liter), for lead of 240 micrograms/L, for cadmium of 180 micrograms/L, for iron of 70 micrograms/L, for manganese of 240 micrograms/L, and for silica of 15 mg/L. Water from mines in the western area contained dissolved-solids concentrations of generally more than 500 mg/L, a median pH of 6.8, sulfate concentrations that ranged between 170 and 2,150 mg/L, and median concentrations for zinc of 3,200 micrograms/L, for lead of 0 micrograms/L (minimum detection limit is 10 micrograms/L), for cadmium of 6 micrograms/L, for iron of 840 micrograms/L, for manganese of 440 micrograms/L, and for silica of 11 mg/L.

No conclusive evidence of lateral migration of water from the mines into the domestic well-water supplies in the shallow aquifer was found in the study area in Kansas. Analyses of water from public-supply wells tapping the deep aquifer did not indicate contamination with trace metals, although chemical analyses from four of six wells exhibited increasing trends through time in sulfate concentrations. These increases probably reflect localized leakage of water from the shallow aquifer along corroded or leaky well casings.

Effects of abandoned lead and zinc mines on tributaries of the Spring River in the eastern area are most severe in Short Creek. Compared with water samples from three other major streams in the eastern area, a sample collected from Short Creek, 2 miles west of Galena, Kansas, during August 1981, contained the largest concentrations of dissolved sulfate (240 mg/L), zinc (25,000 micrograms/L), cadmium (170 micrograms/L), manganese (1,700 micrograms/L), and the lowest pH (6.0). Concentrations of these constituents are due primarily to inflow of ground water from the breccia, mines, and to seepage from chat piles in the Short Creek basin. The largest concentrations of zinc and manganese in the Spring River during August 1981, were observed in analyses of samples collected below Short Creek. In the western area, drainage from tailings, which act as perched aquifers on the impervious Pennsylvanian shales, appeared to have little effect on water quality in Willow Creek during low-flow conditions but caused larger concentrations of dissolved zinc just after a wet period during June 1981. Drainage from tailings cause large concentrations of sulfate, zinc, and cadmium in Tar Creek in Kansas. Compared with four other major streams in the western area in Kansas, Tar Creek contained the largest low-flow concentrations of sulfate (910 mg/L), zinc (5,800 micrograms/L), and cadmium (40 micrograms/L).

— T.B. Spruill

Stone, C.L., M.R.S. Fox, A.L. Jones, and K.R. Mahaffey. 1977. Delta-aminolevulinic acid dehydratase - a sensitive indicator of lead exposure in Japanese quail. Poultry Science. 56:174-181.

Red blood cell delta-aminolevulinic acid dehydratase (RBC-ALAD) activity has proven to be a sensitive indicator of lead exposure in humans. The depressed enzyme activity and its negative correlation to blood lead concentrations are well-known effects of lead exposure in man. The sensitivity of RBC-ALAD activity in young Japanese quail exposed to low levels of lead as lead acetate was investigated. Two groups of nine birds each were fed purified diets containing either no added lead or 25 micrograms of lead per g. of diet. After 2 weeks, blood and tibial tissues were collected. There were no significant differences between controls and lead-fed birds, in body, kidney, duodenal, and tibial weights, or in hematocrit and hemoglobin concentrations. However, the renal, hepatic, duodenal, and tibial lead concentrations were significantly ($P < 0.001$) greater in the lead-treated birds. The activity of RBC-ALAD in the group fed lead was 45% of that in the control group; these values were significantly different ($P < 0.001$). RBC-ALAD activity expressed as the log base 10 showed significant ($P < 0.02$) negative correlation with both hepatic and tibial lead. The study demonstrates that the activity of RBC-ALAD in the Japanese quail is a very sensitive indicator of lead exposure. — Authors' Abstract.

Walker, W.M., J.E. Miller, and J.J. Hassett. 1977. Effect of lead and cadmium upon the boron, copper, manganese, and zinc concentration of young corn plants. Commun. in Soil Science and Plant Analysis. 8:57-66

In a greenhouse experiment corn plants were harvested 24 and 31 days following emergence from pots containing Bloomfield loamy sand (Psammantic Haplaudalf). Soil P was 140 kg/ha, exchangeable K was 220 kg/ha, and soil pH was 6.0. The soil CEC was 2.3 meg/100g. Boron, Cu, Mn, and Zn were determined with emission spectroscopy. Treatment combinations were a factorial arrangement of 0, 2.5, and 5 micrograms/g of Cd and 0, 125, and 250 micrograms/g of Pb.

Main effects of Cd and Pb significantly affected the B concentration of corn plants 24 days following emergence, and specific main effects (linear and/or quadratic) influenced the concentration of other nutrients.

At the later stage of development (31 days following emergence), neither Cd nor Pb affected B concentration in corn plants, and there was only one significant ($\alpha = 0.05$) main effect influencing the nutrient status of other micro-nutrients studied. However, several Cd-Pb interactions

affected micronutrient concentration in corn plants. Our results suggest that the effect of Cd or Pb upon the nutritional status of corn depends upon stage development of the plant as well as the Cd or Pb rate.
— Authors' Abstract.

Whelan, G.E. 1983. The distribution and accumulation of lead and cadmium within a lotic benthic community. M.S. Thesis, Univ. Mo.-Columbia.

Three points are emphasized in this study: "1) sediments have metal complexes that can be mobilized, taken up and accumulated by aquatic biota; 2) Pb and Cd can be toxic to aquatic life; and 3) chronic levels of Pb and Cd could potentially disrupt the functioning, production, and community structure of aquatic systems." It was found that the tailings inputs had elevated total sediment Pb and Cd concentrations, but more important than the concentrations for Pb was the sediment particle size. The finer particle sizes, due to their charged properties and increased surface area available for adsorption, were found to have elevated metal concentrations. Foods, such as detritus and algae, that invertebrates feed on acquired lead through adsorption. Detritus consumers showed the highest metal concentrations as they ingest the smaller, metal-enriched particles. Predators, piercers, and engulfers—all showed elevated lead levels. Both particle size of sediments and food quality are important to metal accumulation in benthic invertebrates. -- D.M. Kania.

White, D.H. and E. Cromartie. 1985. Bird use and heavy metal accumulation in waterbirds at dredge disposal impoundments, Corpus Christi, Texas. Bull. Environ. Contam. Toxicol. 34:295-300.

The study was conducted to determine the extent to which aquatic birds use dredge-pits and to determine the accumulation of heavy metals within these birds. Most birds were found to use the area seasonally and nine species were present more than 20% of the time. Accumulation of metals in the sediment samples were: lead, 49.2 ppm; zinc 847.6 ppm; cadmium, 7.5 ppm; mercury, 0.5 ppm; and selenium, 2.3 ppm. The concentrations within the birds were less than the levels in the sediment and were also no higher than the birds from control sites, except for selenium, which may have an adverse affect on these birds. — D.M. Kania.

Wixson, B.G. (ed.) 1977. The Missouri Lead Study, Volume 1. National Science Foundation, Washington, D.C. 543 pp.

Heavy metals such as lead, zinc, copper, silver, and cadmium were studied in this book because of their hazard to the environment. In Volume 1, lead levels in deer bone, thallium and the use of fruit flies as an environmental

indicator, and other analytical procedures are discussed. Air quality studies were also reviewed, and divided into stationary sources and non-point sources, such as trucking or railroad operation. The major source of heavy metal particulates was found to come from the non-point sources. Although the concentrations were low, they occasionally reached hazardous levels in short-term peaks. Soil content indicated that there may be a problem with heavy metal pollution. Furthermore, the physical-chemical parameters of water quality in the study areas are presented with emphasis on metals, overt and transport, trace organics, new waste treatment techniques, and a comparison between new modern mine-mill operations and techniques used 100 years ago. Biological effects of water quality are also examined. -- D.M. Kania.